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CONSTRUCTION INSPECTION GUIDE

VOLUME 1

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Municipal Construction Division
Office of Water Program Operations
U.S. ENVIRONMENTAL PROTECTION AGENCY
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16. ABSTRACT

This guide was issued by the U.S. Environmental Protection Agency for the use of personnel who inspect the day-to-day construction of municipal wastewater treatment facilities. It is intended to assist construction inspectors in examining the detailed construction of the structural, mechanical, and electrical features of a modern facility.

Volume I covers the following topics: general information; layout and quantity surveys; clearing and grubbing; earthwork; underground pipe systems; paving; grassing, planting and erosion control; and concrete for structures.

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FOREWORD

The Federal Water Pollution Control Act Amendments of 1972 set in motion a comprehensive program to clean up the Nation's waters. Recognizing that many local governments could not afford to build needed treatment facilities without financial assistance, Congress dramatically increased Federal aid to help local governments meet the requirements of the Act. The 1972 Amendments made available $18 billion in Federal grants to local governments for wastewater treatment works. The program is administered by the U.S. Environmental Protection Agency in cooperation with the water pollution control agencies of the various States.

This Construction Inspection Guide is being issued to aid the engineers and technicans who inspect the actual construction of a wastewater treatment facility. It should serve as a guide in examining the detailed construction of the structural, mechanical, and electrical features of a modern facility. It cannot, however, replace plans, specifications, experience, and most importantly, engineering judgement. Whenever a difference exists between the guide and contract documents, or Federal, State and Local requirements, the contract documents or governmental requirements take precedent.

Comments, recommendations, or suggestions for modification or insertion of additional material are solicited. They should be sent to: Director, Municipal Construction Division, U.S. Environmental Protection Agency, 401 "M" Street S.W., Washington, D.C. 20460.

The Environmental Protection Agency extends acknowledgement to the U.S. Army Corps of Engineers, who originally published this guide, and the Naval Facilities Engineering Command, who provided the negatives, for their joint permission to reprint this guide with minor editorial changes.

John T. Rhett
Deputy Assistant Administrator
for Water Program Operations

INSTRUCTIONS FOR OBTAINING ADDITIONAL COPIES OF THIS GUIDE

This guide is available, free of charge, for personnel who inspect the day-to-day construction of municipal wastewater treatment facilities funded in part, by grants from the U.S. Environmental Protection Agency.

To order the "Construction Inspection Guide" write to:

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CHAPER 100
GENERAL INFORMATION

100-01. INTRODUCTION

As an Inspector, you should at all times be thoroughly familiar with all the provisions of the contracts which you are administering. You should be thoroughly familiar with the plans and specifications including all revisions, changes, and amendments. In addition, you should be thoroughly familiar with the pertinent administration policies.

100-02. RESPONSIBILITY

Inspectors have different responsibilities and authorities, this being dependent on the organization set-up which he is working under and the Inspector's own capabilities. Each inspector, however, should know the part he has in the organization, and should have or obtain clear and precise answers to the following questions:

a. Do I understand the importance of my responsibility for the highest quality construction?.

b. Do I have the technical knowledge, tact and good judgment to effectively perform my inspectional duties?

c. Do I fully understand the extent of my responsibility?

(1) Have I accepted all of my responsibilities?

(2) Have I overlooked any of my potentialities?

(3) Have I overstepped my authority?

(4) Do I understand my supervisor's attitude with respect to my responsibilities?

(5) Am I aware of my responsibility to record in my daily report all verbal instruction?

100-03. AUTHORITY

a. Make sure you know the extent of your authority. You always have the authority to require work to be accomplished in accordance with the contract plans and specifications.

b. Check with your supervisor on policies with respect to your authority to stop contractor operations for such things as safety.

violations or construction deficiencies.

100-04. DEALING WITH THE CONTRACTOR

a. Are my relations with the contractor impersonal but friendly, fair and firm?

b. Am I business-like and cooperative with the contractor?

c. Do I have a clear, accurate, and appreciative understand of the contractor's problems.

d. Do my decisions and instructions to the contractor provide the greatest latitude possible, without prejudice and without waiving the contract requirements in choice of equipment, material, and methods?

(1) Are they executed promptly and at the right time?

(2) Are they based on detailed knowledge of all facts, good judgment, and the protection of the interests of my employer.

(3) Will they have any adverse consequences? If so, has my supervisor been informed of the problem?

e. Am I cautious about dictating methods of construction to the contractor unless they are clearly spelled out in the contract?

f. Am I careful about discussing items directly with the subcontractor or workmen without the contractor's knowledge?

g. Do I try to settle all controversies with the contractor promptly?

100-05. PLANS AND SPECIFICATIONS

a. Make a thorough review of plans and specifications during bidding period.

(1) Watch for omissions.

(2) Watch for discrepancies in plans and specifications and between plans and specifications.

(3) Check plans and specifications against requirements with which you have had trouble on similar jobs before.

(4) Compare elevations, grades and details shown as existing on plans with those at the actual site.

(5) Report all errors, omissions, discrepancies, and deficiencies to your supervisor.

b. Always keep a posted and marked up set of plans and specifications convenient for ready reference.

c. Keep informed of all amendments and changes to the contract document, make sure you have copies, and know their contents. Also, make sure that the contractor has the same information.

d. Anticipate contractor's operations and make a thorough review of the plans and specifications as they pertain to each and every operation before it begins.

(1) Discuss the requirements of the plans and specifications with the contractor before each operation begins.

(2) Underline or makes notes of those requirements which need special attention, such as:

(a) Unusual requirements.

(b) Those that the contractor is likely to overlook.

(c) Repetitive deficiencies.

e. Compare the work actually begin performed with each requirement of the plans and specifications.

100-06. SHOP DRAWINGS

a. Review plans and specifications. Make a list of all items requiring shop drawings and items on which shop drawings should be submitted, such as lay-outs for equipment, room, etc.

b. Encourage the contractor to make a similar list and compare this list with the one you have made to eliminate omissions.

c. Require the contractor to furnish information as to when he plans to furnish each shop drawing.

d. Make sure the contractor's shop drawing submittal will be timely so as to aviod delay of construction.

e. Compare the shop drawings to the contract drawings and report apparent differences to your supervisor. Approved shop drawings do not constitute a waiver of a contract requirement.

f. Study the approved submission making sure each detail on the shop drawing is clearly understood.

g. Make continual checks of shop drawing submittals with job progress to prevent delays in construction.

h. Continually check material being installed against the approved shop drawing. Never let material which has not been approved be installed.

100-07. DAILY INSPECTOR'S REPORTS

a. Prepare an accurate daily report. Check that the report tells the complete story of the events on the job each day. Check for the inclusion of the following:

(1) Conditions (weather, moisture, soil conditions, etc.). Note if and how any adverse condition hampered or delayed the contractor's operations.

(2) Activities (include details of each activity).

(3) Difficulties (include all difficulties encountered by your or the contractor).

(4) Controversial matters (disputes, questionable itmes, etc. Also, note if they were settled and, if so, how they were settled).

(5) Deficiencies and violations (include construction, safety, labor, etc.).

(6) Instructions given and received (include how the instructions were transmitted to you and from you).

(7) Progress information (report all delays, action taken, and action contemplated).

(8) Equipment. (Report arrival at the site and shipment from the site of each major item of equipment by manufacturer, model, serial number, and capacity. Report equipment in use and comment on reasons for idle equipment.)

(9) Record tests and results thereof.

(10) Make sure inspector's reports are dated and signed.

b. Spot-check the daily report from time to time to assure that you are recording a complete and understandable report.

100-08. PRE-CONSTRUCTION CONFERENCE

A pre-construction conference will be held with the contractor at project level to discuss and agree upon order of work for all phases of construction, submissions required for approval, safety, etc. Obtain a copy of the minutes from your supervisor and carefully review its contents.

100-09. EQUIPMENT PROPOSAL

Most equipment proposed by the contractor is required to have the approval of the engineer. Approvals of the engineer regarding euqipment.

constitute approval as to general adequacy only. Check equipment frequently during construction to see that it produces acceptable work.

100-10. CLAIMS

a. Always be alert to possible claims or matters of possible dispute.

b. When you discover that a claim or dispute is in the making, notify your supervisor and record all facts in your daily inspector's report.

c. Make sure that adequate and accurate records of facts, materials, labor and equipment associated with the claim or dispute are kept.

100-11. PROGRESS SCHEDULES

a. Render any necessary assistance to the contractor for his preparation of initial and revised progress schedules.

b. Encourage contractor to submit timely progress schedules.

c. Be familiar with the approved progress schedules and carefully watch for any slippage in progress.

d. Anticipate slow downs and delays affecting progress.

e. Promptly report to your supervisor and in the daily inspector's report all indications of any slippage in progress.

f. Suggest appropriate ways to the contractor in which he might improve his progress, and record the suggestions in your daily inspector's reports.

g. When construction falls behind schedule, carefully examine the construction operations for ways the progress can be improved. Report these findings to your supervisor, in your daily inspector's report, and to the contractor. Only suggestions should be made to the contractor. Be very careful not to direct or dictate the contractor's operation.

h. Keep informed of the exact required contract completion date and know the advance notice required by higher authorities for prefinals. Check to see that these inspections are appropriately scheduled.

100-12. LABOR ENFORCEMENT

a. Keep informed of the labor provisions of the contracts on which you are working.

b. Always avoid taking part in any labor disputes.

c. Promptly inform your supervisor of any labor problems and disputes.

d. Check that anti-discrimination posters and minimum wage rates are kept in a conspicuous place.

e. Assist office personnel in assuring that:

(1) The man-hours put in on the work are accurately shown on payrolls.

(2) Payrolls are obtained weekly from each subcontractor who worked on the job.

(3) Each laborer and each machine is classified in accordance with the particular work function.

f. Make spot-checks with contractor's employees to verify that at least minimum wages are being paid.

100-13. STORAGE OF MATERIALS

a. Check to see that adequate space is available for the contractor's operations and storage areas.

b. Check that approval has been obtained for temporary sheds, buildings, etc. which the contractor proposes to install.

c. See that all material and equipment is properly stored and protected.

d. Insure that storage areas are maintained in a neat and orderly manner.

e. Safety Provisions, especially in the storage of flammable or explosive materials and fire hazards, must be adhered to.

f. Make sure that damage will not occur to structures.

g. Assure that the necessary heating and ventilating is provided.

100-14. CONTRACTOR'S PAYMENT ESTIMATES

a. Check specifications for method of measurement and payment for each item of work to be accomplished.

b. Be familiar with schedules of prices and methods of measurement and payment.

c. Assist the Office Engineer in preparation of partial pay estimates.

(1) Make timely measurements of work completed and work accomplished each pay period. It is usually a good idea to seek contractor's concurrence.

(2) Keep orderly, neat and accurate records of measurements.

d. Check material on hand, for which payment is being made, for:

(1) Fair market value of materials.

(2) Quantity and quality having been approved for incorporating into the job.

(3) Proper storage and protection.

(4) Deletion of material which is placed in the job.

e. Be alert to all increases or decreases in quantity of work shown on the unit price schedules as compared to that actually being required to accomplish the construction.

(1) Make as accurate an estimate as possible of all variations in quantities.

(2) Report all variations of quantities promptly to your supervisor.

100-15. RIGHTS-OF-WAY

Check that all rights-of-way are obtained prior to entrance on property.

a. Require written evidence if contractor-obtained.

b. Check contract provisions if they are to be obtained by the owner.

c. Know the limits of right-of-way and locations of stakes that may be used to determine location and elevations.

100-16. PHOTOGRAPHS

a. Check that photographs have been taken of the following:

(1) Views of major construction projects during various stages of completion and when completed.

(2) Scenes of value in connection with changed conditions, claims, or potential claims.

(3) Detailed views of work in place for which removal has been ordered because of non-compliance with plans and specifications.

(4) Construction in which unusual difficulties have been overcome or where the subject is of technical interest.

(5) New methods of construction.

(6) Property or material damages.

(7) Emergency conditions and safety violations.

(8) Accident scenes.

b. Check that each picture taken is completely described and identified.

100-17. RECORD DRAWINGS

100-16. PHOTOGRAPHS

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(5) New methods of construction.

(6) Property or material damages.

(7) Emergency conditions and safety violations.

(8) Accident scenes.

b. Check that each picture taken is completely described and identified.

100-17. RECORD DRAWINGS

a. Has one set of complete contract drawings been designated just for As-built Drawings?

b. Insure that as soon as a change or addition is made in construction it is noted on the As-built Drawing.

c. See that the following general items are being considered in the preparation of the As-built Drawings:

(1) Size and type of existing and new utility lines.

(2) Layout and schematic drawings of electrical circuits and piping.

(3) Correct dimensions and details transferred from shop drawings.

(4) Verification of alignment, cross section, and layout of earthwork.

(5) Actual location of anchors, construction and control joints, etc. in concrete, where they are different from shown on contract drawings.

(6) Changes in location of equipment and architectural features.

(7) Cross out such words and phrases as "optional requirements," "or equal," etc., and list specifically the items of material provided.

100-18. TRANSFER OF CONSTRUCTION

The following records and materials will be needed for transfer of the construction facilities to the owner. They must be obtained and accounted for.

a. Record of Property - Name, make, and model number of each piece of equipment.

b. All equipment test records.

c. Approved shop drawings.

d. Operating and maintenance instructions.

e. Spare parts and tools.

f. Keys.

g. Guarantees.

h. As-built drawings.

100-19. INSPECTION

Remember that inspection starts at the inception of construction and ends only with the final acceptance by the owner. Proper inspection verifies what has been done as well as what may have been left out.

CHAPTER 101

LAYOUT AND QUANTITY SURVEYS

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CHAPTER 101
LAYOUT AND QUANTITY SURVEYS

101-01. GENERAL LAYOUT

It is the responsibility of the engineer to establish, at the site, base lines and bench marks necessary to completely lay out the work. The contractor is required to utilize these established points to perform the necessary survey to execute his work.

a. Ascertain that the established points have been found, and that they are maintained and preserved by the contractor.

b. Insure that the contractor utilizes these points and establishes additional points as necessary to have complete control over the layout of his job.

c. See that the contractor's layout work is accurately performed and that complete notes are maintained.

d. Assure that adequate stakes and templates are provided and maintained by the contractor, and that they are clearly marked.

e. Continually check the contractor's lines and grades of work being accomplished.

101-02. LAYOUT PROCEDURES

a. General - The required order of accuracy of the layout surveys, if not stated in the specifications, must be established at the outset of the work, usually by the Resident Engineer or higher authority. Remember, as a general rule, that the layout surveys must be made with sufficient accuracy that the construction which follows can be held within the specified tolerances. For example, if the specifications require a wall to be constructed within 1/2" of the location shown on the drawings, the work line laid out by the survey party will have to be correctly located within a much smaller margin of accuracy, say 1/8" or 1/16", to leave room for normal variations which must be expected in the construction work. On the other hand, the specified tolerances for the surface of a heavy rock fill might be 1' above and 6" below grade, in which case an error of as much as an inch in the layout would not be harmful.

b. Deviations from Plans - Should it appear necessary or desirable to change the location or dimensions of any part of the work to fit existing work or adjacent work under another contract, to take advantage of more favorable terrain, to rectify an error in the drawings, or for any other reason, report the circumstances promptly to your supervisor.

101-03. QUANTITY SURVEYS

a. General

The engineer is usually responsible for the original and final survey and for the compilation of quantities of work performed or finally in place where estimated quantities are included in the unit price schedule. Where the contract, or portions of the contract, are paid by lump sum, the quantities are often computed by the contractor.

b. Controls

Wherever practicable, cross-section work should be tied in to the same horizontal and vertical controls used for the construction layout. If it is found necessary to establish an independent base line and/or a bench mark with an assumed elevation, as might be the case when cross-sectioning a borrow area remote from the construction site, these controls must be located so that there is no possibility of losing them, or they must be tied in by careful horizontal and vertical measurements to a sufficient number of safely located reference points to insure that the controls can be re-established in the event of disturbance.

c. Instruments and Equipment

(1) Are all instruments and equipment (to be used in making measurements) of a type and quality such that they are capable of maintaining the required degree of accuracy?

(2) Have levels and transits been checked before starting work, to see that they are in adjustment?

(3) Are they checked periodically during the course of the work and readjusted as necessary?

(4) Are adjustments necessary at frequent intervals? This may indicate that an instrument is not in an acceptable condition for the work to be done.

(5) Are tapes and rods checked for accuracy before starting work?

(6) Are tapes and rods checked during the course of the work for damage or wear? Do not permit the use of tapes or rods which have been worn or damaged to such an extent that correction factors must be

applied to measurements taken with them.

d. Measuring Procedures

(1) General - Such items as orientation of the cross-section base line, frequency (spacing) of cross-sections and individual shots, accuracy of tape and rod readings for individual shots, and required degree of precision in orienting the cross-sections perpendicular to the base line depend upon irregularity of the terrain, shape of the excavation, fill, or other volume to be measured, and upon the unit prices of the payment items involved. These standards must be established at the outset of the work, usually by the Resident Engineer or higher authority.

(2) Checking

(a) Is leveling checked by closing on bench marks?

(b) Are distances checked at the end of each cross-section by tying in to an auxiliary parallel base line or by comparison with the adjacent cross-section?

(3) Cross-Sections

(a) Have specifications been reviewed and list made of all payment items for which surveys will be needed to measure quantities?

(b) Are cross-sections extended far enough to include the "catch points" of excavation and fill slopes, with generous allowances for over-excavation?

(c) Are sufficient intermediate cross-sections being taken to catch abrupt changes in slope of terrain?

(d) Are plans referred to frequently enough to insure that cross-sections are taken where needed to show conditions at changes in alignment and to show shape and grade of work?

(e) Is a chart or marked plan being maintained to show the relative locations of cross-sections taken, to show the work in progress, and to insure that cross-sections will be taken in advance of the work?

(f) As cross-sections are taken, the inspector must be alert to recognize all instances where actual conditions differ from those shown on the drawings. Examples: Ground surface higher or lower than indicated; boulders or ledge rock occurring at locations or elevations different from those indicated; evidence of ground water at locations not indicated;

underground or overhead utilities not shown on the drawings. Report the existence of any of these conditions promptly to your supervisor. They may indicate future over-runs or under-runs in contract payment quantities, or troublesome claims by the contractor on account of "changed conditions." Early awareness of these conditions gives the engineer maximum opportunity to study possible design changes to avoid or minimize extra expense.

(4) Recording

(a) Are all quantity measurements accurately and neatly recorded in an orderly manner in one binder, if possible?

(b) Is the record such that anyone at a later date will be able to readily and understandably re-evaluate or examine all measurements and computations?

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CLEARING AND GRUBBING
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CHAPTER 102
CLEARING AND GRUBBING

102-01. PRE-CONSTRUCTION ACTIONS

a. Extent of Clearing, Grubbing, and Disposal Work

Check by a thorough review of the contract plans, specifications, and by reconnaissance of the area.

b. Contractor's Schedule of Operations

Schedule of operations shall be obtained and studied.

c. Work Limits

(1) Determine whether limits have been established in agreement with plans and specifications.

(2) Insure that area to be cleared and grubbed is clearly marked.

(3) Inspect the cut-off elevations.

(4) Check depth and size of roots to be removed.

d. Acquisition of Land or Easements

(1) Do not permit contractor to enter any land on which easements have not been received or on which satisfactory agreement to enter has not been made.

(2) Determine from your supervisor that the rights-of-way are available for construction.

e. Safety of Personnel and Equipment

(1) Identify and post existing and potential hazards, including poison oak, poison ivy, and poison sumac.

(2) Be sure that First Aid Stations are clearly marked and that signs are posted showing location of the station.

(3) Check the Safety Requirements for the particular phase of operation in progress.

(4) Check personal protective equipment, hard hats, gloves, snake-proof leggings, etc.

(5) Inspect equipment for fire protection, guarding of moving parts and pinch points.

f. Existing Power Lines and Other Utilities

Note whether they are properly posted, protected, relocated, or removed as required.

g. Work Requirements

(1) Know the requirements for the different areas.

(2) Check the terrain, soil conditions and growth.

102-02. CLEARING

a. Swamping

(1) Check removal of underbrush, vines, and small trees that will interfere with felling operations.

(2) Determine the number and spacing of workmen in the area engaged in hand clearing work (brush hook and axe operations) to insure safe working conditions.

(3) Inspect the operation of equipment (power saws, dozers, etc.) for sufficient clearance.

(4) Check protective devices and warning signals of equipment and operators.

(5) Establish that the piling of swamped material does not interfere with

felling and logging operations.

b. **Felling**

(1) Inspect tree-climbing equipment.

(2) Note any leaning trees, hollow trees, snags or lodged limbs that may cause trouble during felling operations.

(3) Mark and protect trees to be left standing.

(a) Check trimming of trees to be left standing.

(b) Use approved tree wound paint on scars 1-1/2 inches in diameter and larger, caused by falling timber.

(c) If a tree surgeon is required, consult your supervisor.

(4) Insure that felled trees are kept inside work limits.

(5) Inspect rig for topping.

(6) Determine that workmen are kept properly positioned, within sight or hearing range during tree felling operations. Insist on overhead protection for bulldozer operators.

(7) Check felling methods when such hazards exist as slopes, slippery terrain, rock, or outcrops.

(a) Check undercutting and wedging.

(b) Inspect the condition of such equipment as axes, crosscut saws, power saws, dozers and winches.

(c) Prevent damage to trees to be left standing, existing structures, and/or structures under construction.

c. Decking

(1) Mark merchantable logs.

(2) Inspect hand and power equipment used for bucking operations and the protective equipment required for operators.

(3) Check stacking methods for pile locations, distribution of brush and logs in pile, compaction of pile, and type of decking. Locate piles above high water level.

d. Logging

(1) Check loading and hauling equipment.

(2) Check protective devices and warning signals.

(3) Check access and haul roads for bridge and road limits, clearances, steep grades and hair pin turns.

(4) Check dumping operations.

102-03. GRUBBING

a. Observe removal depths of all stumps and matted roots.

b. Determine maximum size of roots and other materials that may remain in the area.

c. Check method of measurement and payment.

d. See that depressions from grubbing are properly filled and compacted.

e. Inspect operation of equipment.

f. Insure that blasting procedures for stump removal are in accordance with approved methods listed in the "Blaster's Handbook" by E. I. Dupont de Nemours Corp.

g. Check specified limits of grubbing areas.

102-04. DISPOSAL

Determine the disposal requirements and insist that the operation closely follows the clearing.

a. Check disposal of unsalvageable material. Debris will not enter waterways.

b. Check piling and disposal equipment and procedure and the operators' protective devices.

c. Check arrangements made by the contractor for piling and storage of clearing debris on private lands.

(1) Secure a signed letter from the owner acknowleding arrangements made.

(2) Report to your supervisor any unwarranted entry by the contractor or unauthorized disposal of material on privately-owned lands.

d. Locate debris areas above high water flow lines.

e. Observe location, number, and size of piles.

f. Check local fire district, county, state, and U. S. Forest Service Regulations prior to burning.

(1) Location and size of piles.

(2) Time of year burning is permitted.

(3) Standby equipment required.

g. Assure that burning is not allowed in areas where it might cause damage to existing structures, construction in progress, trees, and other vegetation.

h. Check burning schedule for interference with other operations.

i. Determine the kind and usage of fire kindling materials.

j. Complete decking prior to the start of any burning operations.

k. Do not permit burning in high winds.

l. Require constant attendance of burning operations.

m. Check suitability and safety of operations for periodic bunching of deck materials during burning.

n. Insure that fire fighting equipment and personnel are supplied by the contractor.

o. Obtain complete burning. Reduce materials to ashes.

p. Provide that no burning is permitted on the surface of revetments, roads, or existing rock or gravel-type construction.

102-05. CLEAN-UP

Inspect final clean-up thoroughly.

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CHAPTER 103

EARTHWORK

103-01. GENERAL

a. Scope

This chapter covers embankments, grading, and preparation of subgrade for roadways, railroads, and other earthwork structures of similar nature plus excavation, filling, and backfilling for building construction.

b. Survey and Soils Control

(1) A survey crew is generally assigned to conduct surveys or to check contractor's surveys. Soils testing is usually performed by project laboratory personnel or by approved commercial laboratory.

(2) The inspector normally will not physically perform surveys or soils testing. However, he must be familiar with surveys and soil testing to determine that job requirements are met as the work progresses, and to make sure that the surveying and testing is appropriately performed as required. He should record tests made and any action taken as a result of the tests.

(3) Check boring logs in excavation areas prior to construction and obtain samples in order that necessary preliminary testing can be performed in advance for determining disposition of materials at time of excavation.

(4) Confer with your supervisor, survey personnel, and laboratory personnel. Establish liaison so that all concerned will be continually informed of surveys and soil tests. Also arrive at a clear understanding of the nature and scope of records, reports, and other construction data required, as well as individual assignments for obtaining data, and preparation and submission of reports.

c. Samples of Material

Samples of certain types of soils, such as capillary water barrier under floor slabs and base material for roadways, are required to be submitted by the contractor for testing prior to use in the work. Use only tested and approved materials in the work.

d. Standards of Inspection

(1) Uniformly high quality earthwork construction is required. Each step of the numerous operations involved must be given close and continuous attention.

(2) Several classifications of excavation and of embankment materials are generally involved. Control can best be accomplished by maintaining a chart or tabulation of quantities and distribution of materials.

(3) If the contractor fails to operate according to specification requirements or otherwise fails to operate in a manner to produce a satisfactory end product, notify your supervisor and make recommendations for appropriate action. Keep a record of your recommendations in your daily report.

103-02. TOPSOIL

a. Stripping

(1) Check contract requirement for stripping of topsoil.

(2) Watch for contamination of topsoil with subsoil.

(3) See that topsoil is free from roots, stones and other undesirable materials.

(4) Observe depth of topsoil during the stripping operation.

b. Stockpiling

(1) Determine location for stockpile. Check for convenience and interference with other work.

(2) See that stockpiling is kept neat, well-drained, and in a workable condition at all times.

c. Spreading

(1) Check areas to be topsoiled.

(2) Inspect the scarifying and bonding of topsoil with subsoil.

(3) Determine that topsoil is not placed on frozen or muddy surface.

(4) Check thickness of topsoil placed and compacted or seeded.

103-03. EXCAVATION

a. Earth Excavation

(1) Prior to the start of excavation operations, take photographs of the construction area, make sure that sufficient cross-sections are taken, and continue to take progress photographs during construction.

(2) Review the log of borings to ascertain the elevation of the water table and to determine if unsuitable soils are likely to be encountered. Dewatering equipment may be necessary, and disposal for unsuitable material must be provided.

(3) Check utility maps prior to the start of excavation to ascertain existing lines not shown on contract drawings.

(4) Evaluate materials being excavated against logs of borings. If differences are noted, consult your supervisor for determination of action to be taken.

(5) Care must be exercised in selecting disposal areas for unsuitable material so that they will not detract from the beauty of the surrounding landscape, or interfere with proposed future construction.

(6) Check for location of underground utilities. Sanitary and storm drains, electrical cables, communications cables, and gas lines are particularly subject to damage by heavy earth-moving equipment unless protection is provided beforehand.

(7) Insure the utilization of satisfactory materials from excavations and the disposal of unsuitable materials in designated waste areas.

(8) Inspect for contamination and/or wasting of suitable material.

(9) Determine moisture condition of suitable excavated materials in advance of needs.

(a) Consider whether wet soils may be used after a reasonable period of aeration.

(b) Insure that provisions are made to add moisture to excessively dry materials.

(10) Insist that excavation is performed in specified sequence.

(11) Assure that drainage is provided continually as excavation progresses.

(a) Do not permit ponded water in any construction area.

(b) Be sure that drainage ditches are maintained free flowing.

(12) Insure that required tests for soil bearing characteristics are made upon completion of excavation.

(13) Coordinate planning of borrow excavation to insure that the right materials will be available as needed for embankment construction, and that borrow will not be unnecessarily used when excavated material is available.

(14) Inspect borrow pits for:

(a) Adequate stripping.

(b) Orderly removal of materials.

(c) Satisfactory drainage.

(15) After total material removal, check borrow pit areas for conformance with final shaping and drainage requirements.

(16) Determine average volume hauled for each type of hauling equipment. Record daily load count for various classifications of excavation when required for partial payments.

(17) Take final cross-sections.

(18) Provide that quantity surveys

are made for payment purposes.

(19) Examine all excavating equipment for compliance with General Safety Requirements.

b. Earth Excavation - Buildings

(1) Identify any existing utilities at the site and through the local utility agents or companies. Notify the contractor of the location before the utilities are allowed to slow up the contractor's operation or be damaged by equipment.

(2) Determine if such items have been left in excavated material within 5 feet of the building as trees, stumps, roots, brush, vegetation, building foundations, pavements, utilities, and debris.

(3) See that the foundation materials agree with the borings.

(4) Check for the proper fill of all depressed areas or holes.

(5) Inspect sides of excavations for sloping to a safe angle or if sides are made vertical, check adequacy of required bracing to safely retain the sides.

(6) Define provisions made for preventing damage to adjoining property.

(7) Observe method of dewatering excavations and water disposal.

(8) Insure that footing beds in dewatered areas are not disturbed or softened.

(9) See that proper sequence of excavation is carried out for components of the building at different elevations.

(10) Inspect footing and foundation excavations for clearances sufficient to permit erection of forms, installation of services and inspection.

(11) Identify corrective methods used in cases of over-excavation.

(a) Do not modify or change established elevations without written approval.

(b) Correct over-excavation by placing approved, compacted backfill or lean concrete fill.

(c) Keep a detailed record of any such corrective work.

(12) Check provisions for preventing surface drainage into the excavated area.

(13) See that footing drains are installed, if necessary.

(14) Determine special instructions and/or requirements when excavations require use of caissons and cofferdams.

(15) Prevent heavy equipment from operating close to building structures and/or deep excavations.

(16) See that material used for backfill is from an approved source. Require the backfill material to be placed in layers of specified thickness equally and uniformly on each side of walls, open cut tunnels, large pipe, etc., and to be compacted to the required density.

c. Soil Poisoning

(1) Check the requirement for soil poisoning under and around building structures.

(2) Check for approval of material to be used and watch specifically for required concentration.

(3) Check application for coverage and quantity of material used.

d. Rock Excavation

(1) Inspect contractor's procedures for compliance with proposed and/or approved plan of operation.

(a) Drilling and blasting are the commonly used methods for rock excavation. However, picking, barring, and wedging are used to some extent.

(b) Other methods proposed for use in rock excavation should be carefully investigated.

(2) When overburden has been removed and prior to rock excavation, see that necessary surveys are made to determine pay quantities.

(3) Determine compliance with all Safety Regulations.

(a) Carefully inspect handling, storage, and use of explosives.

(b) Insure compliance with city, county, and/or state regulations relative to explosives.

(c) Abide by provisions made for warning notices prior to blasting, including: curtailment of radio transmission, protection at highway and railroad crossings, and warning system for personnel.

(d) Check compliance with restrictions on blasting near fresh concrete.

(4) Check qualifications of contractor's supervisor, drillers, and powdermen assigned to blasting operations.

(5) Inspect drilling and blasting equipment. Do not permit use of unsafe, worn-out or obsolete equipment.

(6) Check drilling depth, evidence of materials encountered in drilling, water in or flowing from holes, and indications of seams or faults shown by drill drop or rate of drilling.

(7) Verify drilling pattern for blasting, quantity, and firing sequence of explosives.

(8) Keep records of the quantities of explosives used.

(9) Check results of each blast, particularly as final excavation lines and/or grades are approached.

(a) Look for over-break, damage to adjacent features, and safety. Drilling pattern and/or quantity of explosives should be modified if unsatisfactory conditions result.

(b) Observe and record over-break that results from structural weakness of rock for which payment will be made.

(c) Examine for and correct unstable rock on sides of completed excavation.

(d) Evaluate installation of necessary rock supports and re-check periodically to see that they are secure.

(e) Insure compliance with restrictions on blasting as final grades or excavation lines are approached.

(f) Insofar as possible, provide that the rock is left in an unshattered, solid condition.

(g) Inspect scaling and removal of loose material from slopes.

(h) Make sure that rock foundations are marked down to a satisfactory bed and side wall to receive concrete.

1. Smooth sloped surfaces are to cut into rough steps or benches.

2. Smooth flat surfaces are to be roughened.

(10) Evaluate trench excavation.

(a) Determine if separate trenches are needed for water and sewer lines.

(b) Insure that trenches are excavated to the minimum required depth below the bottom of pipe and to the required gradient.

(c) Check items in paragraph d(9)(c) as applicable.

(11) Observe the drainage of excavated areas.

(12) Check the disposal of material from rock excavation. Be sure that satisfactory rock is handled and used as required.

(13) Implement necessary surveys for payment purposes.

(14) Watch for the excavation of trenches too far ahead of pipe laying.

(15) Make sure that the specified density is obtained when backfilling trenches.

(16) Maintain a complete record of all unusual conditions encountered.

103-04. FOUNDATION PREPARATION

a. Foundations Other Than for Buildings

(1) Refer to Chapter 102 of this Guide for check items relative to clearing and grubbing.

(2) Observe depth of stripping and disposal of stripped material.

(3) Examine earth foundation areas for evidences of peat, mulch, humus and other unsuitable material. Remove.

(4) Inspect filling and compacting of foundation depressions.

(5) Evaluate densities of earth foundation materials prior to constructing embankment.

(6) Note drainage of foundation area.

(7) Assure that scarifying of earth foundation areas or other procedures required to effect bond between foundation and embankment materials are properly employed.

(8) Insure that rock foundations to receive impervious fill have all loose rock and other foreign material removed by specified methods.

(9) Similarly, check rock foundations to receive concrete.

(10) Define special foundation treatment required.

(11) Inspect marking and protection of all features that are to remain in the construction area, such as trees, poles, and structures.

(12) Record all cracks or faults, actual or possible, by taking pictures and/or plot maps, calling them to your supervisor's attention.

b. Building Foundations

(1) Compare foundation conditions with conditions shown on the drawings. Report and record unusual conditions.

(2) Make note of unsuitable materials in the foundation bed. Remove unsuitable materials and backfill with suitable materials. Keep accurate records of any such work.

(3) Review grade, smoothness, and compaction of bottoms of excavations.

(4) See that final grade for foundations in rock is properly excavated so as not to cause breaking or shattering.

(5) Consider the order of footing excavation. Lowest footing areas should be placed first.

(6) Check the effectiveness of dewatering excavations. Do not permit accumulation of water in footing excavations.

(7) Insure that provisions are made to prevent surface water from entering excavations.

103-05. EMBANKMENTS AND BACKFILL

a. Survey Control

(1) Be familiar with locations of established bench marks and base lines. Be sure that all control points are protected from damage during construction.

(2) Determine that the contractor's layout of work complies with specification requirements.

(3) Insist that all original ground surveys necessary for use as basis of payment to the contractor are made in the project area, borrow areas, etc.

(4) Assure that final surveys are made as each phase of the work is completed.

(5) Review elevations of all completed excavations and embankments for compliance with specifications.

b. Preparation

Prior to the placement of embankment or backfill, check:

(1) Removal of required vegetation, such as roots, brush, heavy sods, heavy growth of grass, decayed vegetable matter, rubbish, and other unsuitable material.

(2) Compaction of ground surface.

(3) Plowing, stepping or benching of sloped surface steeper than 1 vertical to 4 horizontal.

(4) Determine the contractor's plans for the installation of all drainage and drainage structures before placing embankments.

c. Haul Roads and Ramps

(1) Inspect haul road layout. Restrictions on haul road type and haul routes may be imposed.

(2) Inspect haul road construction within an embankment area and require

that the same material with the same moisture-density relationship be used for the embankment.

(3) View construction ramps. Do not permit cutting through a compacted embankment; construct ramps out from the embankment.

(4) Provide that original moisture content of haul road surfaces within permanent fill and excavation areas is maintained.

(5) Route vehicular traffic on embankment sections so that compactive effort will be uniformly distributed over the area.

(6) Insure that water is obtained from an approved source in an approved manner.

(7) Insist that established roadways used for hauling are kept clean and smooth at all times, and that dust is kept to a minimum.

d. Ditching

(1) Maintain control of ditching operation with timely spot cross-sectioning, and the checking of grades, shapes and slopes.

(2) Areas of excessive excavation should be immediately backfilled and compacted.

(3) Inspect for the complete removal of all roots, stumps, rocks and foreign matter inside the excavated area.

(4) Insure the adequate disposal of excavated material. In no case should the material be left closer than 3 feet from the edge of the ditch.

(5) Inspect the maintenance of the ditch. It is usually the contractor's responsibility to maintain ditches until final acceptance of the work.

(6) Be sure that the excavation is carried on in such a manner as to prevent surface water from flowing into the trench or other excavations.

e. Embankments

(1) Make classification of the soils being used for embankment formation. Dispose of all unsuitable material before it becomes deposited in the embankment.

(2) Evaluate contractor-provided hauling and compacting equipment for quantity, type, and condition.

(3) Examine the workable moisture content ranges of the soils to be used and the natural moisture content of the soils.

(4) Scrutinize the contractor's operations to see that full advantage is taken of the soil's natural moisture.

(5) Determine that adequate testing is performed and that results indicate that satisfactory moisture and density is obtained.

(6) Determine the need for wetting, drying, or mixing of fill obtained from excavations or from borrow pits. Insure that action is taken to uniformly moisture-condition the soils as necessary in advance of needs.

(7) Note controls for spreading material.

(a) Insure adequate mixing equipment (such as plows, discs, etc.) on site for the mixing and breaking up of material and to provide uniformity of moisture distribution and material.

(b) Measure lift thickness.

(c) Notice uniformity of materials and moisture content.

(8) Note compaction of the material and record results.

(a) Start compaction operations as soon as possible after soil has been placed and satisfactorily conditioned with the specified moisture content.

(b) Check rollers and roller coverage.

(c) Check for tearing action in roller turn areas. Re-roll area as necessary to obtain required density.

(d) Check roller action for evidences of excessive moisture content in the soil or for evidences of exceeding the soil bearing capacity. Soil densities should increase with an increase in the number of roller passes.

(e) Evaluate operation of hand-manipulated tamping equipment for complete compaction coverage at optimum water content.

(f) Measure compacted layer thickness.

(g) Watch uniformity of density.

(9) Inspect surface drainage of each lift.

(10) Insure removal of oversize stones, roots and debris from materials as they are placed.

(11) Investigate installation of required settlement gages and piezometers.

(a) Check connections and plumbness of each section as progressively installed.

(b) Obtain and record readings each time the tubes are extended.

(12) Determine that required record tests are taken.

(13) Observe final alignment, section and grade.

(14) Seal each layer with light pneumatic equipment to preserve the moisture.

(15) Scarify and wet each layer prior to placing each succeeding layer, and check bonding between layers.

f. Backfill of Trenches and Building Excavations

(1) Analyze condition of material at bottom of trenches and/or excavations. Remove wet or unstable material and replace with compacted, suitable material.

(2) Evaluate material employed for pipe bedding.

(3) Look into the shaping of pipe beds for bottom quadrant of pipe, and see that bell holes are being excavated so that pipes are uniformly supported over their entire length.

(4) Check the material for plasticity, gradation, and frost susceptibility, and see that the proper material is placed in the correct section.

(5) Check width of trench bottoms for storm drains. Width should not be greater than the dimensions specified.

(6) Examine materials to be used for all backfills. Insure that material is compacted under pipe haunches.

(7) Inspect all excavations for removal of all debris and frozen material prior to backfilling.

(8) Notice placement of layers and uniformity of compaction and density results.

(a) Insure that precautions are observed in backfilling against walls, and that sufficient time has elapsed for curing of concrete.

(b) Assure dewatering of excavations to be backfilled.

(c) Insist that material be placed at optimum moisture content.

(d) Observe all cold weather placing requirements.

(9) See that sufficient depth of fill is over the pipe prior to permitting heavy equipment to pass.

(10) Report to your supervisor all indications of damages to walls or structures by backfilling operations, and determine if corrective action is required.

103-06. FINAL GRADING AND SUBGRADE PREPARATION

a. Final Grading

(1) Compel conformance to required lines and grades.

(2) Insist on uniformity of smoothness and compliance with surface smoothness requirements.

(3) Check drainage of finished surfaces.

(4) Observe the functioning of ditches and drainage structures.

b. Subgrade Preparation

Note: Subgrade as used herein is defined as that portion of the surface of any embankment, fill or excavated area on which protective or base course materials are to be placed and all areas to be topsoiled and seeded.

(1) Check lines, grades and shaping of sub-grade.

(2) Check for evidence of soft, yielding or otherwise unsatisfactory material. Remove and replace as necessary.

(3) Check for boulders and ledges in cut areas. Remove or break off to required depth.

(4) Check moisture content and compaction immediately prior to placement of protective or base course materials.

(5) For additional check items, see Chapter 105 of this guide.

103-07. DRAINAGE FILLS FOR SLABS AND STONE PROTECTION

a. Drainage Fills for Slabs

(1) Check material for compliance after compaction.

(2) Check rolling and/or operation of hand-operated tamping equipment for complete and uniform compaction coverage. Particularly watch compaction adjacent to walls, columns and other similar areas.

(3) Check layer thickness.

(4) Check densities for uniform required compaction.

(5) Check shaping of surface for conformity with line, grade and surface tolerances.

(6) Check cold weather protection.

b. Stone Protection

(1) Check approval of materials.

(2) Check uniformity of stone size and/or gradation prior to and after placement.

(3) Check equipment used and placement procedures.

(4) Check thickness of protection.

(5) Check lines and grades for conformity with tolerances.

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UNDERGROUND PIPE SYSTEMS
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CHAPTER 104
UNDERGROUND PIPE SYSTEMS

104-01. GENERAL

This chapter covers excavation, trenching, backfilling, and laying of underground pipe systems to a point within five feet of buildings and structures. The types of underground pipe systems considered are as follows: Water, storm subdrainage, sanitary, fuel, gas, steam, high and low temperature hot water.

a. Plans, Specifications, and Layout

Prior to the start of field construction, the plans and specifications should be thoroughly reviewed.

(1) Observe existing utilities and all possible interference with existing systems.

(2) Confer with local utility agents to ascertain that all utilities are indicated on the contract drawings. Utilities not shown on contract drawings should be entered on record drawings.

(3) Check all electrical facilities, both aerial and underground.

b. Accessibility of Valves, Hydrants, and Manholes

All valves, hydrants, and manholes should be constructed in such manner that they can be utilized in the future. Hydrants should be accessible for operation.

c. Lines and Grades

Lines and grades should be established and staked, and reference bench marks should be set, before any excavation or pipe-laying operations.

(1) Check each type of utility being installed within a project for conflict as to the layout and elevations at each point of crossing.

(2) Check for conflict with existing utilities.

d. Connections to Existing Utilities

Plan and coordinate connections to existing utilities. Under no conditions will an existing utility service be interrupted without full coordination with the operator of such service.

e. Interference

Hold traffic interference to a minimum when installing utilities in or under walks, streets, or railroads.

(1) Determine that materials are on hand and that work is organized, so that interruptions will be held to a minimum.

(2) Insure that warning signs and obstruction lights are placed and that regular traffic is not tied up excessively.

(3) Detour traffic when necessary, if possible.

f. Damages

See that completed pipe installations are not damaged by movement of construction equipment over or near pipe.

g. Testing

Tests shall be performed prior to backfilling, while visual inspection can be made.

(1) Inspect every joint.

(2) Check blocking and pipe bedding.

(3) Assure that the accomplishment of corrective action is in accordance with requirements.

104-02. PIPES AND FITTINGS

a. Approval of Material

(1) Determine the approval of all material needed for and used in pipe laying. Make sure all material used has been approved.

(2) Compare approved submittals with material brought to the job. Check for type, grade, strength, classification, size and condition of materials. Make sure that pipe fittings, such as tees, ells, and couplings, correspond to the weight of pipe.

(3) Verify the provision of miscellaneous items such as valves, service boxes, stops, special connections, tapped tees, etc.

b. Handling and Storage

(1) See that pipes and fittings are handled with the proper tools and equipment. Do not permit dragging and handling of pipe with chains, wire ropes and the like.

(2) Check damaged pipes, fittings, and pipe coating. Reject all damaged materials promptly, and have rejected

materials removed from the job-site immediately.

(3) Make sure adequate and accessible storage area has been provided.

c. Field Coating

(1) Check the availability of an approved coating-testing device.

(2) Check for breaks and abrasions of pipe coating.

(3) Determine requirements for repairing damaged surface coatings.

(4) Implement requirements for cleaning of surfaces before coating.

(5) Follow the requirement for painting with primer and sealer.

(6) Check for the requirement to coat edges or ends of pipe and bolt threads.

d. Laying Pipes - General

(1) Check the pitch, line, and grade of the pipeline trench or bed before laying proceeds and after completion of each section.

(2) Observe method of jointing permitted.

(3) For most types of pipe the manufacturers have very valuable installation information available. This should be obtained and used as a general guide for installation. Where there is a difference between this information and the contract specifications, this difference should be called to the attention of your supervisor.

(4) Check for cleanliness of pipe (especially joints) during placement and after completion.

(5) Insure that all pipe to be placed on earth is placed on dry, firm soil.

(6) Check for obstructions in pipe, such as pipe plugs, debris, etc.

e. Waterlines

(1) Grade lines to avoid high points as much as possible. Where high points occur, check specifications for requirements for vacuum and relief valves.

(2) See that fire hydrants are plumb and facing the roadway.

(3) Measure height of the pump nozzle above finish grade. Check height of oper-

ating valve nuts.

(4) Observe the hydrant barrel drain.

(a) Plug the drain in locations of high ground water where the hydrant is specified to have no drain.

(b) In areas where the ground water is low, the drain plug must be removed.

(5) A well-installed water main does not move.

(a) Check blocking.

(b) Check for movement at joints, bends, dead ends and hydrants.

(c) Check wedging at all fittings.

(6) Check that fire hydrant threads conform and fit the hose or fire-fighting equipment which will be connected to them.

(7) Do not omit the sterilization phase of the construction work on water lines.

(a) Main to be thoroughly flushed with water until all entrained mud and debris have been removed.

(b) Add sterilizing agent in easily applied form and recommended dosage.

(c) Solution to remain in contact with line at least 8 and preferably 24 hours.

(d) There should be no less than 10 ppm residual at extreme end of line at end of contact period.

(e) Flush entire system thoroughly.

(8) Insure that valves are accessible and try turning the valve nut after backfilling is completed.

f. Fuel Gas Lines

(1) Do not permit lines to be buried under buildings, nor in trenches with other utilities.

(2) Enforce safety regulations rigidly during construction of gas lines.

(3) Check and recheck the area with an explosion meter.

(4) When there is indication of an explosive condition, do not commence work until the area has been cleared.

(5) Install gas pipes above other utilities which they cross, and with a minimum cover of 2 feet. Pipe under pavements or heavily traveled areas will be encased or located deep enough so that there will be no damage from heavy traffic.

(6) Check cleanliness of pipe before lowering into trench.

(7) Check pipe coating for damage during connecting, laying, and backfilling operations. Permit coated piping to be handled only by hand or with non-metallic flexible slings.

(8) Keep pipe clean during installation by carefull handling and by keeping ends of pipe closed.

g. Sanitary Sewers

(1) Check distance separating sewers from water line. Always install sewer below water line if the lines are within 6 feet horizontally, unless special provisions are taken at crossings.

(2) Check to see that spigot end of pipe is pointed downstream in pipe line.

(3) Check that uniform grade is maintained between manholes. Assure that top elevation of manhole is flush with paving grades or higher than finished grade of ground surrounding area, as specified.

(4) There are specific safety precautions to be taken when working in sewers. Sewer gas may be explosive or incapable of supporting life. Check need for assigning at least two men to the work.

h. Storm Sewers

(1) Check that installation is performed by proceeding upgrade with spigot or tongue end of pipes pointing in the direction of flow.

(2) Check the installation of all fittings, joints, connections at manholes, and connections to existing facilities.

(3) Check grade, elevation, and finish of paved inverts.

(4) Check that elliptical pipe sections are handled carefully in transporting, storing and installing.

(5) Check for installation of all subdrain tile as shown on plans.

(6) Where watertight joints are required, see that hydrostatic test requirements are met, and that rubber gaskets are not affixed more than 24 hours prior to pipe installation and are protected from sun, dust, and other deleterious agents.

(7) Provide covering to prevent the entrance of earth into the pipe.

i. Steam Distribution Lines

(1) All heat distribution piping is subject to expansion and contraction. Check that all lines are straight, both vertically and horizontally.

(2) Expansion of piping will be absorbed by expansion joints or fabricated pipe loops. There must be room for the pipe loop to move and for maintenance.

(3) Verify strength, security, and proper placement of anchors and supports.

(4) Inspect rigid installation of anchors.

(5) Require uniform pitch of steam pipe. Trap all low points.

(6) Follow the manufacturer's recommended installation procedure for the insulation materials, unless there are specific changes on the approved shop drawings.

(7) Store and protect insulation from the weather.

(8) Keep underground pipe conduit system dry during and after construction.

(9) Examine waterproofing extremely carefully.

(10) Manholes should be watertight. If water is entering a manhole, advise your supervisor.

(11) Check welding of pipe lines for compliance with specification requirements and the applicable codes.

(12) Insure that all changes in direction are done with approved type fittings.

(13) Check welds or metal casing on underground steam lines for leaks and holidays in asphalt coatings.

j. High Temperature Hot Water Lines

(1) Installation details are, in general, similar to those described for "Steam Lines".

(2) Require that all low points in the system are drained and high points are vented.

(3) Examine clearance for thermal expansion.

(4) See that the back end of all expansion loops have a void or space for expansion.

(5) Observe methods used to remove ground water from system.

k. Fuel Lines

(1) Fuel lines in this section pertain to underground liquid petroleum systems.

(2) Check drain connections at low points.

(3) Check air releases at high points.

(4) Check that field application of covering on joints is not done until the pneumatic pressure test has been conducted and the joints proved satisfactory.

(5) Check if screens and filter elements are installed; check mesh and material; check installation for proper direction of flow; and

check clearances for removal of screen and access to drain connection.

(6) Vapors of fuels may accumulate in pits or enclosed areas and can cause serious explosions.

(a) Provide adequate ventilation during operation in a liquid fuel area.

(b) Prohibit open fires, sparks, or static electricity in the vicinity of vapors which may be explosive.

(c) Check by use of an explosion meter.

104-03. JOINTING OF PIPES

a. General

(1) Check to see that all jointing surfaces are kept clean.

(2) Do not joint pipes in mud and water.

(3) Constantly be on the alert to check tightness of joints.

b. Hot-pour Joints

(1) Hot-pour joints must be clean and dry. The presence of moisture may cause explosion and possible injury.

(2) Check for uniformity of annular space.

(3) Check method of application and make sure all joints are adequately filled.

(4) Check temperature of the compound.

c. Poured Lead Joints

(1) Check pack for uniformity and tightness.

(2) Check depth and amount of lead being placed in joints.

(3) Check the pouring operation for method of filling and for one continuous pour.

(4) Check driving during packing. If lead is permitted to be displaced to a depth greater than 1/4 inch, the joint should be remade.

d. Flexible Joints

(1) Check for approved material, make, type, and number of splices, etc.

(2) Check placing and positioning of flexible gasket.

(3) Check depth of gasket with a gauge.

(4) Check use of lubricant.

(5) Make hydrostatic test as soon as possible.

e. Tapered End Couplings - Drive tapered end couplings, for jointing bituminous fiber pipe, up tight.

f. Cement Mortar Joints

(1) Determine specific requirements for types of joints, whether Oakum, Diaper band, etc.

(2) Insure that mortar meets requirements of specifications.

(3) Observe that the jointing operation will completely fill joints and form a bond on the outside.

(4) Cure cement mortar joints.

(5) Remove excess grout from inside and outside of pipe.

g. Pipe Threads

(1) Cut pipe threads with sharp tools.

(2) Provide proper length thread.

(3) Ream pipe flush on the inside surface

(4) Apply joint compound to the threads on the pipe, not to the fittings.

(5) Make up all joints tightly.

h. Copper Tubing Joints

(1) Correlate types of pipes and fittings used against types required.

(2) Cut copper tubing off square and remove burrs.

(3) Insure clean tubing before fluxing and soldering.

(4) Check type of tools used for flaring compression type joints.

i. Welded Joints

(1) Inspect welders' qualifications and approved procedure.

(2) Prior to any welding, obtain the code assigned to each certified welder to insure that welded joints are stamped and can be properly identified

(3) Fabricate and weld as much as possible before lowering pipe into trench.

(4) Check against possible cave-in when welding in trench.

(5) Explore for explosive gases within pipes and before welding in fueling areas.

(6) Check pipe ends for bevel.

(7) Make a very careful check of welds in hard to reach areas.

(8) Remove all welding slag.

j. Corrugated Banding

(1) Laps of all circumferential joints in the pipe should provide that the outside lap be on the downstream side of the joint with the longitudinal laps on the side of the in-place pipe.

(2) All markings indicating the top of the pipe should coincide with the specified alignment of the pipe.

(3) While the connecting band is being placed, assure that the band is going to fit tightly.

(4) Check for the requirement, or necessity, to use bituminous material at the joint after jointing.

k. Caps or Plugs

(1) Close open ends of pipe when work is not in progress.

(2) Keep pipe lines clean of all debris, rodents, or water.

104-04. MANHOLES, CONCRETE CRADLES AND ENCASEMENTS

a. Materials - Check material requirements and compare detailed plan requirements with those in the specifications.

b. Construction

(1) Check dimensions and layout.

(2) Check invert elevations and details of the invert channels in manholes.

(3) Check placement of material such as concrete, reinforcement, brick, block, plaster,

frames and covers, rungs, etc., for the same workmanship as for other structures.

(4) See that manholes are not obstructed by dumped waste concrete or other construction debris.

104-05. EXCAVATION, TRENCHING AND BACKFILLING

a. Excavation - Existing underground utilities will be carefully excavated and protected.

(1) Check need for shoring or excavate to required slope.

(2) Report all damaged existing utilities to your supervisor for corrective measures.

(3) Note location of all unknown or unreported utilities for inclusion on revised utility plan.

(4) Determine that access steps or ladders are provided in trenches, where necessary, and that they are maintained in safe condition.

b. Trenching - Begin trench excavation for sewers at the lower end of the line and proceed upgrade to protect the work from possible flooding, unless job conditions prohibit.

(1) Check specifications and job requirements for maximum width of trench and minimum depth of pipe.

(2) Check bed of the trench for grade and suitability of materials before any pipe is laid. If the trench is overexcavated, bring the bed to grade and compact. When encountering rock excavations, check the minimum overdepth specified and check that backfilling is performed with select material.

(3) Keep water from the trenches during construction. Use pumps or a well point system.

(4) Check that final hand grading precedes pipe laying by no more than the amount of pipe that can be installed the same day. Special conditions may limit the distance to a few feet.

(5) Check excavation of bottom of trench. Is it graded and shaped to bottom quadrant of sewer pipe, and has excavation under all bells been performed as specified?

(6) Inspect distances between potable water lines and sanitary sewer trenches for minimum allowable clearance.

(7) Check pipe-handling procedures to determine if loads are being swung over the heads of workmen.

c. **Backfilling**

(1) Permit placement of backfill only between pipe joint locations until all lines have been tested and/or approved, unless job conditions require otherwise. In the case of pressure testing, place sufficient backfill material to prevent pipes from moving out of place. In the case of wrapped and coated piping, do not permit any backfilling until the coating at welds and fittings has been completed and the entire coating tested for holidays. Assure that backfill in contact with the piping does not injure protective coatings.

(2) Check backfill material, assuring placement in uniform layers on each side of the pipeline.

(3) Insure removal of foreign materials and large stones prior to backfilling.

(4) Backfill Operation

(a) Check thickness of each layer for moisture content and compaction. Especially watch for compaction around lower portion of pipe, and watch for any movement of pipe.

(b) Do not machine compact fill on top of a pipeline until required minimum cover has been placed.

(c) Check that there are no large or sharp rocks used.

(d) Check the maximum size of stones permitted.

(e) Assure that no improperly compacted backfill is placed in pipe trenches when inspector is absent.

(5) Check sewer lines to manhole after the backfilling operation. Check from manhole for broken pipe, settlement in the line, lateral movement, and cleanliness.

104-06. SUMMARY

The plans and specifications must be rigidly adhered to. All questionable items should be reported to your supervisor.

CHAPTER 105

PAVING

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CHAPTER 105
PAVING

105-01. GENERAL

a. Objective - The objective in constructing any pavement is to provide a pavement satisfying design criteria and possessing such uniform characteristics of quality that it will have maximum serviceable life with minimum maintenance. This objective may be achieved only through painstaking attention to each step in the construction of a pavement. This check list will call to your attention items requiring careful thought and consideration relative to preparation of sub-grade, construction of sub-base and base courses, priming of prepared base course, tacking bituminous binder course, and placement and finishing of the pavement surfacing.

b. Control Testing - General

(1) The determination of satisfactory materials on the basis of samples submitted prior to construction and the design of starting mixes for bituminous and Portland cement concrete pavements is normally a function of a paving engineer.

(2) Modify concrete batch weights to maintain uniformity of grading and to adjust for free moisture on the aggregates.

(3) A project laboratory is usually equipped to conduct soils tests and to control mixing plant production. The inspector normally will not physically conduct tests but he must be familiar with the tests and significance of test results.

(4) Minimum frequency of control testing is generally established by specifications or good judgement.

(5) Adequacy of processing, batching and/or mixing plants is normally determined through joint inspection by the inspector, his superiors or supervisors, and the paving engineer.

(6) Confer with project laboratory, paving engineer, and your supervisor and agree on a form of liaison such that all concerned will be kept informed of test results, changes in character of materials, mix changes, behavior of mix, etc. During this conference, arrive at a clear understanding of the nature and scope of records, reports, and other construction data required, as well as individual assignments for obtaining data, and preparation and submission of reports.

c. Contractor Proposals

(1) The specification often require the contractor to submit samples of soils, aggregates for pavement surfacing, bitumens, concrete curing compound, joint-sealing compounds, etc. for testing prior to use in the work.

(a) Be familiar with arrangements for testing the materials.

(b) See that materials are submitted far enough in advance not to delay construction.

(c) Know test results.

(d) Permit only tested and approved materials in the work.

(2) Obtain a copy of the minutes of all construction conferences from your supervisor and carefully review their contents.

(3) Check that all equipment used by the contractor has the approval of the engineer.

(a) Approvals of equipment constitute approval as to general adequacy only.

(b) Continued use of equipment during construction that does not produce acceptable work should not be permitted.

d. Changes in Plant Operation

(1) The inspector should be very cautious in making direct changes in any plant operation. If approval has been obtained through necessity, the following changes can be made:

(a) Modify bituminous mix hot bin weights to maintain grading and bitumen content within limits established by job mix formulae or revised formulae.

(b) Changes in gradations and/or proportions, if changed in the design mix.

(2) The possible cause or causes of deviations may be discussed with the contractor or plant superintendent to assist or give guidance, but watch instructions, directed or implied.

(3) If the contractor fails to operate in accordance with specification requirements or otherwise fails to operate in a manner to produce a satisfactory end product, your supervisor should be notified and recommendations made concerning appropriate action necessary.

105-02. PREPARATION OF SUBGRADE

a. Planning

(1) Have good knowledge of the project area including clearing, grubbing and stripping requirements, location and extent of cut and fill areas and nature of soils anticipated to be encountered.

(2) Is the planned order of work for handling, disposing, and using excavated materials suitable?

(3) Determine that contractor layout of work complies with specification requirements. Be familiar with required grades of finished subgrade.

(4) Be certain that all original ground surveys, necessary for use as a basis of payment to the contractor, are made in the project area, borrow areas, etc.

(5) Be thoroughly familiar with drainage features and all embedded items that may be existing or are to be installed below top of subgrade.

(6) Know requirements for soils and compaction for various features of the work in cut and fill areas.

(7) Is contractor-proposed order of work in clearing, grubbing, stripping, excavation, backfilling, spoiling, embankment construction and compaction in cut areas proceeding in accordance with approved procedures, using approved equipment, with sufficient number of units, to accomplish the work in scheduled time?

b. Construction

(1) Are the materials encountered of the same soils classification as those indicated on the contract drawings? If not, notify your supervisor without delay so that appropriate action may be taken.

(2) Is suitable material from excavations being used to the maximum extent practicable?

(3) Is excavation being performed to provide drainage from the excavated area at all times, if natural drainage is possible?

(4) Are all pockets of soft, yielding or otherwise unsatisfactory material being removed and replaced with suitable material? If in doubt concerning removal of unsatisfactory material, consult your supervisor.

(5) Have ground surfaces to receive subgrade embankment material been prepared?

(6) Are embankments being constructed in the specified layer thickness of suitable material and compacted?

(7) Are embankment surfaces (subgrade) struck-off, leveled and compacted to grade and surface smoothness tolerances?

(8) Are surfaces in cut areas being compacted with suitable equipment to obtain the specified depth and degree of compaction?

(9) During the compaction of each layer of embankment, check to see if the moisture content of the soil is being maintained at or near the optimum moisture content. If not, require drying by aeration or moistening by watering, as the case may be.

(10) Do prepared surfaces of cut areas (subgrade) meet grade and surface smoothness tolerances?

(11) Is finished subgrade protected from traffic or other operations until the subbase or base is placed?

(12) Are subdrains required? If so, are they being installed at the required locations and grades?

(13) Is trench backfilling being performed as required, using satisfactory materials compacted in specified layer thickness?

(14) Is control testing of the subgrade and subgrade materials being performed in accordance with the minimum sampling schedule developed for the project?

(15) Do test results indicate that materials meet all specification requirements? If not, has action been taken to correct any deficiency? Where action has been taken to correct deficiencies revealed by tests, have retests been made, recorded, and cross-referenced to test failure?

(16) Are all test results properly recorded on established reporting forms and adequate project records maintained?

105-03. SUB-BASE AND BASE COURSES

a. Review Prior to Construction

(1) Review project specifications.

(a) Know requirements for the types of base course materials.

(b) Know the maximum and minimum compacted layer thicknesses permitted.

(c) Know the compaction requirements for each type of base course material.

(d) Know acceptable construction procedures.

(e) Know grade control and surface smoothness requirements.

(f) Check the Special Conditions of the specifications for items that may amplify or supplement the Technical Provisions.

(2) Review project drawings.

(a) Fix in your mind the type or types of base courses required for the various pavements involved.

(b) Know the location and extent of the various types of pavements.

(c) Know the total thickness of each base course type.

(d) Be familiar with grades to which the base courses are to be constructed.

(e) Be sure you are familiar with the location and nature of all utilities in place or to be constructed. You should plan to have offset reference stakes set so that position of utilities may be determined after embedment if necessary.

(f) Know the nature and location of all drainage features.

(g) Know the location of all hand holes, man holes, observation risers and other structures or features to be installed within the pavement area.

(3) Review proposed source or sources of base course material.

(a) Check with your supervisor on status of materials approval and obtain copies of approval letters.

(b) Tentative approval only is given on materials at their source. Final approval is based on tests of material in place and compacted.

(c) Be familiar with results of tests on samples submitted which were the basis for tentative approval.

(d) In general, select and sub-base materials are natural or "bank-run" materials which may be obtained from site excavations or from on-site or off-site borrow areas. Base materials are generally crushed and plant processed materials.

(4) Inspect approved source or sources of material.

(a) If material is bank-run, be sure pit is stripped of all unsatisfactory material and that excavation will result in obtaining a uniformly acceptable material.

(b) If "bank-run" materials are to be stockpiled, check that stockpile area is cleared and leveled as required and that proposed methods of stockpiling are satisfactory.

(c) If material is plant processed, inspect plant and determine that processing, handling and stockpiling methods established will produce uniformly acceptable material at a rate to satisfy approved construction progress.

(5) Check all equipment brought on the job by the contractor.

(a) Be sure that specified and approved equipment types are available.

(b) An adequate number of units in good mechanical condition must be furnished to perform the work in accordance with approved construction progress schedules.

(6) Determine proposed procedures of handling high-quality base course materials.

(a) Some high quality base course materials are required to be furnished in two or more size groups and blended by means of a mixing process.

(b) Check that equipment for mixing is on hand and is adequate to produce acceptable material at a satisfactory rate.

(7) Determine that the necessary owner furnished equipment is available for field control of soils and for checking lines, grades and smoothness of base courses as they are constructed.

c. Construction

(1) Are the weather and temperature within the limitations specified?

(2) Inspection of Pit or Quarry Operation.

(a) Is the pit yielding material that will, with little or no question meet requirements for in-place and compacted base course?

(b) Are uniform materials resulting from excavation and handling operations?

(c) Are unsuitable materials being wasted or otherwise handled to prevent hauling to the project?

(d) Is material being processed as necessary and do materials produced leave any question as to suitability?

(e) Check that method of stockpiling is controlled to minimize contamination and/or segregation?

(f) Are the base course materials being sampled at source in accordance with locally established procedures and are they being tested?

(g) If materials are not properly excavated, processed and/or handled, or if materials produced leave any question in your mind, have you taken steps to correct the difficulty?

(h) Check that pits and/or quarries are left in a satisfactory condition.

(3) Test embankments may be required.

(a) Check for this requirement, as

in some cases, procedures and equipment required are established on the basis of test embankments.

(b) If required, be sure test embankment is constructed and determination of procedures has been made prior to full scale placement of base courses.

(c) Know procedures and equipment required by results of tests of the test embankment.

(4) Hauling Equipment.

(a) Do not permit vehicles to continually follow in the same tracks in areas to be paved.

(b) Spread out the tracking over the area insofar as possible.

(c) See that hauling equipment complies with General Safety Requirements.

(d) Determine if back-up alarms are required; if so, they must be provided and maintained in operating condition.

(5) Check methods being employed to spread the material.

(a) Methods differ for different types of base courses.

(b) Spreading must be carefully controlled to minimize segregation.

(6) Check method of mixing.

(a) Check method specified.

(b) Check equipment used.

(c) Check result being obtained.

(7) Check to see that base and subbase materials do not become mixed.

(8) Check thickness of layers. Do they meet limitations on maximum and minimum layer thicknesses?

(9) Check compaction of each layer of subbase and/or base course.

(a) Is approved equipment used and is uniformity and complete coverage of the area attained?

(b) Watch for change in types of materials in that different types of materials are best handled and compacted with certain types of equipment and different compactive effort.

(c) Check equipment for conformance with specification requirements.

(d) If approved equipment types or procedures do not produce the specified results, consult your supervisor.

(10) Check for ruts or soft-yielding spots produced during rolling. Has proper action been taken to correct such weak spots either through stabilization procedures or removal and replacement of materials?

(11) Is water being added to the base course material or is the material being aerated to obtain optimum moisture content and therefore maximum compaction?

(a) Compaction increases strength of most soils. However, some soil types lose strength when compacted or may have other unusual characteristics.

(b) Your specifications will adequately cover any special procedures necessary for the soil type used.

(12) Move and reset grade stakes within the area being compacted, after each layer of sub-base and base course is constructed. This must be done to eliminate the possibility of uncompacted material along a line of grade stakes.

(13) Check the surface smoothness of each layer and/or the surface of the completed base course.

(14) Check the thickness of the completed sub-base and/or base courses.

(15) Check that sampling of in-place materials has been done in accordance with minimum sampling requirements and that test results are suitable.

(16) If failure to meet specification requirements is indicated by a test or tests, has the area involved been determined and immediate appropriate action taken to correct the deficiency?

(17) Require the specified width of shoulder be placed and compacted along with and at the edges of each layer of sub-base and base course.

(18) Is grade control being performed by the contractor, and has the contractor's work been spot-checked by the engineer?

(19) Proof-rolling of base courses and tops of sub-bases is necessary for some portions of flexible pavements. Check proof-rolling requirements.

(20) Check that the edges of sub-base and base courses or shoulders are being

treated as specified. Check requirements for forms.

(21) Check for adequate maintenance of sub-base courses.

105-04. BITUMINOUS PRIME AND TACK COATS

a. Advance Planning

(1) Review project plans and specifications.

(a) Know the grades of bitumen specified for the prime and tack coat.

(b) Know the quantity limitations of bitumen application for both the prime and tack coats.

(c) Know requirements for sampling, testing, and approval of the bitumens.

(d) Know application requirements and limitations.

(e) Know methods of measurement of and payment for application of prime and tack coats.

(2) Determine proposed sources of bitumens. Determine that test samples have been submitted, tested, and approved as required.

(3) Check contractor's equipment.

(a) Does distribution equipment conform to requirements for proper heating and circulation of bitumen, for control of spreading rate and uniformity of application, and for measuring and indicating devices?

(b) Is specified power equipment available and in good operating condition for the cleaning of surfaces to be primed or tacked?

(c) Know requirements for equipment that will be needed to store materials.

(4) Check with field laboratory to insure that base course to be primed or pavement course to be tacked has met all test requirements.

(5) Inspect base course and/or pavement course to be sure it is clean and free of foreign material or free water.

(6) Check temperature and weather outook to be certain that the bitumens will be applied in accordance with specified weather limitations.

b. Application

(1) Is the area to be primed well-defined by using strong lines to insure

sufficient primed area with true lines and neat edges?

(2) Is surface ready to receive primer or tack?

(a) Is it cleaned of objectionable subtances.

(b) Is it too wet or too dry for primer?

(3) Check weigh bills and delivery tickets to be sure that the required and approved bitumen is being applied.

(4) Make continuous check on functioning of distributor.

(a) Is rate of bitumen application as specified?

(b) Does the amount of prime applied completely seal the surface voids of base courses without a surplus remaining on the surface after the curing period?

(c) Does the amount of tack applied appear to be sufficient for bonding but not in excess of the minimum necessary for bonding?

(d) Is application of bitumen uniform?

(e) Take prompt corrective actions in the event of unsatisfactory distribution.

(5) Check to insure that the bitumens have adequately cured in the minimum time or whether additional time is necessary for proper curing.

(6) Is the primed or tacked area being protected prior to and during paving operations?

(7) Record quantities of bitumens used each day.

(8) Check that proper protection is provided to keep bitumen off of posts, guard rails, and other roadside structures during spreading operations.

(9) Are junctions satisfactory?

105-05. BITUMINOUS PAVEMENT

a. Initial Checks

(1) See that adequate fire protection is provided.

(2) Review project plans and specifications.

(a) Know the specification requirements for aggregates, aggregate handling, mixes, mixing plant, and hauling, placing and rolling equipment.

(b) Know construction procedures for spreading and rolling of the mix and preparation of joints.

(c) Know requirements for grade control and surface smoothness.

(d) Be thoroughly familiar with physical location of pavements, thickness and number of pavement courses required, and finished pavement grades.

(3) Aggregate Submissions and Mix Designs

(a) Has approval of proposed materials and development of the starting job-mix formulae been made?

(b) Review and become familiar with aggregate and mix test data developed at time of approval.

(4) Aggregate Storage Facilities

(a) Make sure the required separate stockpiles are provided.

(b) Check preparation of area proposed for stockpiling of aggregates to insure against contamination of aggregates.

(c) Review stockpiling methods and transferring facilities. Check for segregation, contamination and/or intermixing of the different aggregate sizes.

(5) Check bituminous liquids storage facilities.

(a) Is storage tank capacity sufficient for at least a one-day run?

(b) Are pipe lines and fittings insulated?

(c) Are storage tanks equipped with heating facilities?

(d) Has a system been provided for circulation of bituminous liquids between the storage tank and the mixer?

(6) Batching and Mixing Plant

(a) Check type of plant that contractor proposes against type specified.

(b) Check aggregate dryers for capacity and control of moisture conditions of the materials, aggregate discharge temperature measuring devices, and capability for changing slope and rotation speed.

(c) Check condition and operation of hot aggregate screens. Damaged screens should be replaced. Screen sizes used should maintain a reasonably uniform distribution between the several hot bins.

(d) Make sure that a sufficient number of cold bins are provided.

(e) Check hot bins for capacity and condition.

1. Are at least three compartments provided, and does each have an accurate weigh-box and a control gate?

2. Are the partitions free of openings that would allow run-through of material from one bin to another?

3. Have overflow pipes been installed in each bin compartment to prevent overflow of material from one bin to another?

4. Has provision been made for accurately and safely sampling hot bin materials?

(f) Check accuracy of aggregate weighing or proportioning devices. Have separate adjustments been provided to proportion each aggregate bin?

(g) Check bitumen weighing or volumetric-measurement devices and test calibrations for accuracy. Has provision been made for positive control of temperature of the bituminous material?

(h) Check calibration of mineral filler proportioning device.

(i) Check dust collector and method of handling dust.

(j) Check thermometric equipment provided for measurement of bituminous liquids and hot aggregate temperatures.

(k) Check mixer unit.

1. Is mixer of at least the minimum capacity and in satisfactory operating condition?

2. Has provision been made for properly heating the mixer?

3. Check blade clearances. If a continuous-mix plant is employed, are blades adjustable and reversible?

4. Have the time lock, for control of mixing time, and the batch counter been provided and do these devices function properly?

(l) Check pug mill discharge hopper.

1. Check capacity.

2. Is the discharge hopper positioned at the proper height for the transporation equipment?

3. Check ability to completely dump all of the mix.

(m) Check all safety features of the plant for compliance with contract safety requirements. Check for guards over belts, gears, chains, pulleys, projections, rotating parts, etc. Check the insulating of hot piping.

(7) Transporting, Placing and Finishing Equipment

(a) Check trucks that are hauling mix.

1. Are truck beds tight, clean and smooth?

2. Have suitable covers been provided to protect the mix?

3. Have facilities been provided for cleaning the inside of truck bodies and coating with a minimum amount of a concentrated solution of hydrated lime and water.

4. If long hauls are contemplated, have the truck bodies been insulated to insure that delivery temperatures of mix are within the range specified?

(b) Check spreader.

1. Inspect for overall condition and freedom from obvious damage or fault.

2. Stringline screed for correct alignment. Slight camber in the order of 1/8 inch is recommended on front screed.

3. Check for indented and irregular area. This is a sign of a defective spreader.

4. Check functioning of screed heating system.

5. Inspect tamping bar for wear and proper movement and clearance from screed.

6. Inspect hopper, bar-feeders, distributor screws and similar devices for ability to prevent segregation.

7. Check controls for speed of motion and guidance.

(c) Check rollers.

1. Determine that the minimum number and types of rollers required have been provided.

2. Check roller weights.

3. Inspect roller wheels for smoothness. Check scrapers, sprinklers

and water spreading pads for even wetting of wheel surfaces.

4. Check operation of rollers for range of speeds and capability for changing direction smoothly.

5. Inspect pneumatic-tired rollers for tire sizes, number of tires, tire pressures, tracking, weights, and wetting devices to properly moisten the tire surfaces. If not self-propelled, be sure towing unit is adequate and smooth-tired.

(d) Check hand tools.

1. Necessary and specified lutes, rakes, shovels, and other hand tools must be available.

2. Equipment for maintaining small tools in a hot condition must be provided.

3. Material and equipment must be on hand for painting cold joints.

(8) Sampling Schedule for Materials and Mixes

(a) Check that previous arrangements made to sample and test bituminous liquids, aggregates and plant mixes in schedule are in force.

(b) Similarly, check that samples of the completed pavement are obtained and tested.

(9) Plant Dry Runs and Test Sections

(a) Plant dry runs are considered desirable and in some cases are specified. This operation consists of placing the batching plant in operation, filling the aggregate hot bins and obtaining aggregate samples. It permits observation of general plant operation and the checking of cold aggregate proportioning and resulting hot aggregate separation prior to producing mix.

(b) Prior to full scale paving operations, it may be required that a quantity of mixture be produced to construct a test section. Observe all operations in connection with the test section as this is the basis of final determination of adequacy of materials, equipment and construction procedures.

b. Paving Operations

(1) General - Placing and finishing operations for hot and cold paving mixtures

are essentially the same, except that the control of temperatures on delivery and during rolling is not required for cold mixtures.

(2) Layout

(a) Check the contractor's operation at the beginning of placement.

(b) Has he started at the highest lane in the area, and is he moving in the direction of the main traffic flow?

(c) Is the operation laid out so as to maintain a uniform surface?

(d) Will the lanes be placed so the joints will have required texture, density and smoothness?

(e) Have the necessary stringlines been established?

(f) Stringline parallel to centerline of full pavement width should be used to align first lane. Pavement must be laid parallel to the centerline and excessive edge irregularities should not be tolerated.

(3) Production Control

a. Control of the production of bituminous mixtures is usually the responsibility of the Project Control Laboratory. The inspector should be familiar with the laboratory facilities, test methods, control tests, and records maintenance.

b. Test methods to be followed are incorporated in the project specification by reference to appropriate standards. Copies of all standards should be on file in the engineer's office and available to you for reference.

(4) Plant Inspections

(a) Check all bitumens as received. Check that material has been shipped from a pretested tank at sources of supply or has otherwise been sampled and tested.

(b) Check storage facilities for bitumens.

(1) Check that the approved materials are heated and delivered to the mixing unit within permissible temperature ranges.

(2) Check that bitumens are not

overheated. No heating of asphalt emulsions is required.

3. If temperatures are taken through an open hatch, do not use an open flame for better vision of tank contents and thermometer reading.

(c) Check aggregates as received at the plant for similarity to previously checked and approved material. Visual inspection plus gradation tests will usually suffice to determine that reasonably uniform material from the approved source is being supplied.

(d) Check handling and storage of aggregates to insure that methods used will not produce segregation and that uniform feed of uniformly graded materials is maintained.

(e) Check hot-bin materials.

1. Is the temperature range being maintained?

2. Is the dryer temperature obtaining the degree of dryness required?

3. Determine that gradations of hot materials are such that the aggregates are proportioned to result in a combined

grading within limitations set by the job mix formula.

(f) Batching and Mixing

1. Check plant scales periodically for accuracy of a batch-type mixing plant. Check calibrations of feeds for a continuous mixing plant.

2. Check that proportions of materials batched are in accordance with the job mix formulae and that resultant mix is within job mix formula tolerances.

3. Check temperature of bitumen near discharge valve at mixer unit.

4. Check duration and control of mixing time.

5. Check mixer blades for wear.

6. Are all required safety features provided and satisfactorily maintained?

(g) Hauling Units

1. Check that truck bodies are maintained in a clean condition and coated with a minimum amount of a concentrated

solution of hydrated lime and water to prevent adhesion of the mix.

2. Are the trucks equipped with suitable covers and is each load being covered as it leaves the plant?

(5) Check surface of prepared base course for cleanliness and prime coat. Determine that grades and surface smoothness are within specified tolerances. Do not permit unnecessary traffic on prepared base course.

(6) Placement of Mix

(a) Check temperature of mixture (hot-mix) as delivered. Specifications prescribe minimum acceptable placing temperatures for hot-mix (235° F. for asphaltic mixtures and 160° F. for tar mixtures). Reject mixtures arriving at the spreader having temperatures less than the specified minimum. Tar mixtures will be compacted in accordance with specified requirements.

(b) See if weather limitations are being met.

(c) Appearance of mixture should be

noted as indication of properly batched and mixed material. See Plate No. 1 for common types of mix imperfections and probable causes.

(d) Plant Inspector should be notified immediately if mix is found unsatisfactory for any reason.

1. Reject any unsatisfactory mix delivered and instruct contractor to suspend placing operations until necessary corrections are made.

2. Report such action to your supervisor immediately.

3. Record details of suspension of operation in the project log.

(e) Hopper surfaces, tamper, screed, and other contact surfaces of spreader will be maintained in a clean condition.

(f) Set screed on board of approximate thickness of new pavement at start of run (or lanes), or start off previously placed lane.

(g) Check adjustment of screeds to lay course of desired thickness; make further adjustments if course thickness varies excessively.

(h) Screed contour will be straight on rear (trailing) edge, crowned approximately 1/8 inch on front (leading) edge.

(i) Check spreader operation frequently to prevent overloading and spilling, segregation, irregularity in alignment, and grade.

(j) Check rate of feed of mixture from hopper, operation of distributing devices, and screed adjustment and take corrective measures promptly when irregularities in thickness, surface smoothness or width of laid mixture are found.

(k) Check irregular spots.

1. Rakers will level off any irregular spots, but avoid excessive raking.

2. Do not permit raked out material to be cast over the fresh surface.

3. See that all coarse particles unavoidably raked out to the surface is removed from the mat.

(l) Preparation and placing of paving mixture at joints should be checked to insure well-bonded and dense joint areas and even surfaces after rolling. Lane widths and layout of longitudinal joints for multiple course pavements must be planned so that joints of completed pavement courses will break by at least one foot.

(m) Stop placement of paving mixture when weather conditions preclude laying of pavement in a satisfactory manner. It is customary to permit loads in transit to be placed unless conditions are so severe that satisfactory results appear unattainable. Loads wet excessively by rain should be rejected.

(n) Record of location of truck loads should be kept so that identity can be correlated with in-place samples subsequently taken for tests.

(o) Keep weigh tickets of material placed as a basis for payments and to account for rejected loads.

(p) Check yield twice daily by measuring area of lanes laid and comparing with weigh tickets of material delivered.

(q) Check roller operation and rolling procedures.

1. Rollers and rolling requirements are specified. Determine the precise rolling pattern and method to be followed during placement of the required strip.

2. Are rollers being operated within specified speed range, do they reverse without back lash, and are drum scraping and

wetting devices functioning to keep wheels clean and moist?

3. Keep rollers moving; do not permit them to stand on freshly placed mix. Make sure the rollers make the required overlap.

4. Rubber tired rollers are effective only on warm mixture; such rolling is not effective when the pavement temperature is below 130° F.

5. Roll longitudinal joints while the mix is hot to produce a tight, well-bonded joint.

6. Straightedge check for surface smoothness compliance, after the first roller coverage.

a. The time to correct smoothness and grades is when rolling first begins.

b. To correct depressions, loosen material by raking to a depth of 1/2 inch and add necessary hot material by shoveling and raking.

c. To correct humps, loosen by raking to a depth below final grade, remove excess material and rake smooth.

7. Check for compliance with smoothness requirements immediately following completion of tandem rolling. Take necessary corrective action.

8. Surface checking and movement of the mat on the first or second pass of the roller may be caused by one or more factors illustrated in Plate No. 2 attached. Check base course surface for loose fines, moisture or excessive primer, and the binder course surface for cleanliness and excessive tack coat.

9. Transverse and longitudinal cracks occurring under rolling usually result from soft base conditions but may be a result of inadequate control of mix temperatures and mix proportioning. Removal and replacement of pavement and base courses is generally necessary in the case of soft base conditions.

10. Check final finish of pavement to assure that voids or scars are not left in the pavement surface.

(q) Strict adherence to the grade and surface tolerances for all courses is mandatory. Take corrective actions if deficiencies exist.

(r) Spot check daily finish grade and smoothness of pavement as a guide to continuing operations. Determine that complete grade and surface smoothness checks are made and recorded by personnel from the Engineer's office.

(s) Finish shoulder adjacent to finished pavement as soon as possible.

(t) Safety requirements should be rigidly enforced. Watch for unnecessary smoking, fires, and open flames. See that the necessary respirators are used around toxic fumes.

(u) Check for special requirements.

1. Check requirements for joints between old pavements and new ones, or for cutting into old pavements.

2. Check requirement for any special treatment required at edges of pavement.

3. Check requirements for any patching of existing pavements.

c. Check Sampling and Testing - Although the plant control laboratory is responsible for control, the inspector has certain related responsibilities and must be familiar with sampling and testing procedures to determine that the pavement is properly constructed. The frequency of a complete coverage series of tests during a production run normally will be one set of samples for about each 200 tons produced. A complete coverage series will normally include the following, but additional or repeated tests may be required:

(1) Specific readings for temperatures of bitumen and aggregate on discharge from hot bins **or dryer.**

(2) Samples from each hot bin for gradation tests and moisture determinations.

(3) Samples of bituminous mixture after discharge from pug-mill.

(4) A series of compaction tests (not less than four specimens per test) of the bituminous mixture sample for the determination of Marshall stability, flow, voids (total mix), voids (filled with asphalt), and unit weight.

(5) An asphalt cement extraction test on the sample of bituminous mixture.

(6) At the completion of determinations in the complete test series, the

laboratory posts results on trend wall charts. These charts should be reviewed frequently by the inspector.

(7) Plant control laboratory personnel will frequently inspect batching and mixing operations for accuracy.

(8) Sufficient cores (4 inches in diameter) or sawed samples for determining thickness, density, and composition should be taken and tested daily to determine conformance with the specification requirements. One-half the number of all density samples should be taken at a joint,so that the joint is approximately in the center of the sample to be tested. Corrective measures in rolling and placing methods will be taken immediately in the event density of samples does not conform to specification requirements.

(9) Exchange of information and test data between placing inspector and field laboratory will be made promptly. Coordination between the inspector, the technician, and the paving engineer or his equivalent is a must.

(10) A test section or sections is required to be constructed before full scale

paving operations are started for large pavements; otherwise, test sections will be constructed as required by the project specifications. Full scale paving may be started only when inspection, sampling and testing of the test section indicates satisfactory procedures and results. Any unsatisfactory test section constructed in an area of the permanent work should be removed and replaced.

105-06. EPOXY-ASPHALT PAVEMENT

a. Planning for Inspection

(1) Study plans, specifications and approved submittals.

(2) Know requirements for aggregates, binder material, mixing plant, placing equipment, etc.

(3) Know construction procedures for grade control, placing, compacting, formation of joints, testing, etc.

(4) Check to assure timely submittals for approval of materials.

b. Materials

(1) Aggregate

(a) Check for aggregate approval, records of initial sampling and testing, location of source, and gradation requirements.

(b) Know requirements for sampling from hot bins at trial runs, from hot bins at intervals during paving mixture production, at processing plant, at railroad cars, at trucks and at stockpiles.

(2) Binder Materials

(a) Check epoxy resin, flexibilizing additive and the asphalt against the approval material.

(b) Check procedures for later sampling.

(c) Check manufacturer's instructions for proportioning of epoxy-binder ingredients.

c. Mixing Plant

(1) Check plant for being a weight-batch type and for capability of producing a mixture meeting the job-mix formula.

(2) Check operation and sensitivity of scales.

(3) Check scales for capability of weighing each size aggregate and for having a single telltale actuator.

(4) Check storage equipment for heating capacity and safety. (Flames should not come in contact with materials.)

(5) Check circulating system for size and capability of continuous circulation.

(6) Check insulatinn of pipelines and fittings.

(7) Check the feeder of the dryer for type, ability to feed and adjust each material separately, and ability to lock proportioning gates into place.

(8) Check dryer capacity.

(9) Check screen sizes and capacity.

(10) Check bins for capacity, overflow provisions, an indicator to indicate when a bin is too low in aggregate, and a safe sampling means.

(11) Check binder control unit for means of insulating and transferring binder components in pipelines, meters and buckets. Check means of determining percentages of binder components.

(12) Check thermometers for method of shielding and automatically recording temperature and gage ranges.

(13) Check means of controlling mixing time.

(14) Check dust collector for its method of handling dust.

(15) Check method of accurately weighing each size aggregate used in each batch.

(16) Check mixer unit for heating system, blades and method of operation and control.

(17) Check for unsafe features.

d. Placing Equipment

(1) Check operating features of spreader and the results obtained from the trial run. Check surface texture and irregularities of the material spread.

(2) Check rollers for weight, general suitability, method of keeping wheels clean or uniformly wet, as required, and check spacing of wheels and signs of backlash when reversing the machine.

(3) Check suitability of miscellaneous equipment such as blowers and brooms, power saws and core drills.

(4) Check details and recording devices of weigh house and scales. Determine if the scales have been tested and approved.

e. Mixing

(1) Check temperature of aggregate at hot elevator and in sand bins.

(2) Check temperature and flow of epoxy resin, flexibilizing additive, and asphalt.

(3) Check for thorough mixing of the binder material.

(4) Carefully check all weight against design mix.

(5) Check mixing time of aggregates, aggregate with binder, and mineral filler, if used.

(6) Check for spillage of mix and foam in mix.

(7) Take or supervise the taking of

all necessary samples.

(8) Check mixture as it is discharged into the truck, the appearance, and temperature.

f. Transportation of Mix

(1) Check method of transportation of mix. Check for tight, clean, smooth truck bodies.

(2) Check time mix is in truck.

(3) Make sure mix is not allowed to get wet.

(4) See that facilities are provided for cleaning the inside of truck bodies and bodies coated with a minimum amount of approved thinning oil.

g. Placing of Pavement

(1) Check weather and assure that pavement will be placed on dry surface and at atmospheric temperature of at least 50° F.

(2) Check condition of base course or existing pavement to receive epoxy.

(a) Check cleanliness.

(b) Check compaction, grades and surface tolerances. Require the reworking of all areas not complying with specifications.

(c) Check **the requirement for** leveling course on existing pavements.

(3) Check contractor's method of control of grades on finished pavement. Check lines and grade-stakes.

(4) Check requirement for primer or tack coat, when required. Check material used, distribution, and curing.

(5) Check operation of spreader, and check speed and adjustment for thickness, smoothness, and texture of layers.

(6) Check layout and timing of paving operation for proper jointing and lane construction sequence to insure specified compaction, density, smoothness, and texture.

(7) Check the beveling and overlap of edges.

(8) Check areas requiring hand spreading and compacting and carefully check the operation.

(9) Check rolling operation for timeliness of rolling, number and type of rollers, watering of tires, and **pattern or rolling**. Do not allow rollers to stand on freshly placed pavement.

(10) Check pavement crown, grade and smoothness immediately after initial rolling and have necessary corrections made.

h. Curing of Pavement.

See that no traffic of any kind is allowed on pavement until it is fully cured.

105-07. SPECIAL APPLICATIONS OF ASPHALT

a. Check for special applications of asphalt such as for athletic facilities.

b. Check for gradation requirements and special mixes.

c. Check for special density and smoothness requirements.

d. Check for color coating.

(1) Check curing time of bituminous surface prior to applying coloring.

(2) Check rate of application of color coating.

(3) Check material being applied for required characteristics.

(4) Check application of line paint.

(5) Check for crazing, peeling, and bleeding of asphalt through the coatings.

(6) Check for testing requirements.

TYPES OF HOT PLANT MIX PAVING MIXTURE DEFICIENCIES AND PROBABLE CAUSES

PROBABLE CAUSES OF DEFICIENCIES IN HOT PLANT MIX PAVING MIXTURES

ITEM	1 AGGREGATE SCALES OUT OF ADJUSTMENT	2 BRIDGING OF HOT AGGREGATE IN BIN	3 BITUMEN SCALES OUT OF ADJUSTMENT	4 LACK OF PROPER WEIGHING BY OPERATOR	5 FAULTY PUG MILL DUMP GATE	6 BITUMEN TEMPERATURE TOO HIGH	7 DRUM FEED NOT UNIFORM	8 IMPROPER DRYER OPERATION	9 TOO LITTLE BITUMEN	10 TOO MUCH BITUMEN	11 SAMPLING METHOD NOT UNIFORM	12 EXCESSIVE MOISTURE CONTENT OF AGGREGATE	13 BIN OVERFLOW PIPES NOT FUNCTIONING	14 LEAKY BINS	15 SEGREGATION OF AGGREGATES IN BIN	16 MIXING TIME NOT UNIFORM	17 MINERAL FILLER FEED NOT UNIFORM	18 AGGREGATE TEMPERATURE TOO HIGH	19 TEMPERATURE MECHANISM OUT OF ADJUSTMENT	20 IMPROPER FEED OF AGGREGATES TO DRYER	21 OVERRATED DRYER CAPACITY	22 FAULTY SCREEN OPERATION	23 OVERLOADED PUG MILL	24 IMPROPER SET ON PUG MILL	25 BITUMEN AND AGGREGATE FEED OUT OF ADJUSTMENT	26 BITUMEN PUMP NOT FUNCTIONING PROPERLY	27 NOT SUFFICIENT HOT AGGREGATE IN STORAGE BIN	28 AGGREGATE GATES NOT PROPERLY SET
TYPES OF DEFICIENCIES THAT MAY BE ENCOUNTERED IN PRODUCING HOT PLANT MIX PAVING MIXTURES																												
BITUMEN CONTENT FAILS TO CHECK JOB-MIX FORMULA	X		X	X	X				X	X	X		X	X		X	X			X				X	X	X	X	X
GRADATION FAILS TO CHECK JOB-MIX FORMULA	X	X		X	X						X		X	X	X		X			X		X		X	X		X	X
POORLY MIXED LOADS					X	X										X							X	X				
FAT, RICH MIXTURES	X		X	X	X					X	X			X			X			X					X	X		X
LEAN OR BURNED MIXTURES	X		X	X	X	X		X	X		X			X				X	X	X					X	X		X
MIXTURE TEMPERATURE FAILS TO CHECK JOB MIX						X	X	X										X	X		X							
SMOKING LOADS							X	X										X	X	X								
STEAMING LOADS							X	X				X							X	X	X							
OVERWEIGHT OR UNDERWEIGHT LOADS		X	X	X	X														X									
LACK OF UNIFORMITY OF MIXTURES IN LOADS		X	X	X	X	X			X	X		X	X	X	X	X	X		X	X	X	X	X	X	X		X	X

TYPES OF HOT MIX TROUBLE

ITEMS 6 TO 23 INCL ARE APPLICABLE TO ALL TYPES PLANTS ITEMS 1 TO 5 INCL AND ITEMS 24 TO 28 INCL ARE APPLICABLE TO BATCH PLANTS AND VOLUMETRIC PLANTS RESPECTIVELY

PLATE NO 1

105-51

TYPES OF HOT PLANT MIX PAVEMENT IMPERFECTIONS AND PROBABLE CAUSES

PROBABLE CAUSES OF IMPERFECTIONS IN FINISHED PAVEMENTS / TYPE OF PAVEMENT IMPERFECTIONS THAT MAY BE ENCOUNTERED IN LAYING HOT PLANT MIX PAVING MIXTURE	BLEEDING	BROWN, DEAD APPEARANCE	POOR SURFACE TEXTURE	ROUGH UNEVEN SURFACE	UNEVEN LATERAL JOINTS	UNEVEN LONGITUDINAL JOINTS	ROLLER MARKS	PUSHING	WAVES	CRACKING	HONEYCOMB	DISTORTION	TEARING OF SURFACE DURING LAYING	RICH OR FAT SPOTS
EXCESSIVE PRIMECOAT	X													
IMPROPER PROPORTIONING			X	X				X		X	X			X
UNSATISFACTORY BATCHES IN LOAD	X		X	X				X		X	X		X	X
POOR HANDWORK BEHIND SPREADER				X	X	X			X		X	X		
EXCESSIVE SEGREGATION IN LAYING			X	X						X	X			
INADEQUATE ROLLING				X			X					X		
POOR SPREADER OPERATION				X		X			X		X	X	X	
MIXTURE TOO HOT OR BURNED		X						X						
MIXTURE TOO COLD				X	X	X		X	X	X	X		X	
ROLLING MIXTURE WHEN TOO HOT				X				X	X			X		
ROLLING MIXTURE WHEN TOO COLD				X		X	X			X				
POORLY GRADED MIXTURE			X					X		X				
UNSTABLE BASE COURSE				X								X		
FAULTY ALLOWANCE FOR COMPACTION					X	X								
ROLLER STANDING ON HOT PAVEMENT				X					X					
MIXTURE TOO COARSE			X							X	X			
LACK OF BITUMEN IN MIXTURE		X								X			X	
EXCESS OF BITUMEN IN MIXTURE	X							X						X
INADEQUATE CROSS ROLLING				X			X					X		
NOT CUT BACK TO UNIFORM THICKNESS					X	X								
EXCESSIVE MOISTURE IN MIXTURE		X						X						

PLATE NO. 2

105-08. CONCRETE PAVEMENT

a. Items to Check Prior to Beginning of Pavement

(1) Review plans and specifications.

(a) Become familiar with location, extent, and grades of all pavement features.

(b) Become familiar with requirements for survey control.

(c) Know required thicknesses of pavement and the required jointing system. Become familiar with the various types of joints required.

(d) Know location and nature of embedde items within and below the pavement and of all structures within the pavement.

(e) Know requirements for materials, plant and equipment.

(f) Know specified construction procedures.

(g) Determine the number of test specimens required. Review test specimen curing procedure.

(2) Materials

(a) Acceptance or approval of cement, air-entraining admixtures, concrete curing compounds and joint-sealing compounds is based on tests of samples taken at origin of shipment. Each shipment to a project is inspected at origin and sealed or otherwise identified as accepted material. Determine through your supervisor that sources of materials have been proposed by the contractor and that arrangements have been made for sampling and testing.

(b) When above-mentioned materials arrive on the project, check approvals and identifications to be certain that materials have been shipped from pre-tested stock.

(c) Determine that proper storage facilities for the above-mentioned materials have been provided.

(d) Check on concrete aggregate.

1. Have samples been submitted for acceptance tests and mix designs in accordance with specification requirements? Contractor sampling must be witnessed by a representative of the engineer.

2. Study aggregate approvals when available and be familiar with the source

and type of aggregate and results of tests on samples submitted.

3. Determine that the aggregate storage area has been prepared to avoid inclusion of foreign material with the aggregate and that the area is graded to provide drainage.

4. Give particular attention to initial aggregate shipments to determine that the materials furnished are similar in every respect to samples submitted for approval.

(e) Check to see that miscellaneous materials, such as reinforcements, tie bars, dowels, joint fillers, and water have been approved.

(f) Check requirement for the contractor's obtaining approval of the design mix for the concrete which he will use. Make sure that exact proportions of materials composing the concrete mix have been approved.

(3) Batching Plant

(a) Inspect plant for general overall compliance with specification requirements.

(b) Is the plant capable of batching at the minimum rate or at a rate consistent with proposed construction progress? Can the plant maintain the accuracy required?

(c) Check aggregate bins or compartments for condition and size. Is the arrangement of the bins and provisions for loading the bins such that there will be no intermixing of the various aggregate sizes?

(d) Check linkages of weighing devices for condition, cleanliness and freedom of movement.

(e) Check cement and aggregate scales for accuracy.

(f) Has provision been made for interlocking batching controls?

(g) Check recorders and their operation.

(h) If a central mix plant is employed, check water batcher for accuracy of batching and interlock of filling and discharge valves; also check air-entraining admixture dispenser.

(i) Have facilities been provided for obtaining samples of aggregate from each bin?

(j) Does the plant conform to all safety requirements?

(4) Concrete Mixing Plant

(a) Check mixers for general condition, cleanliness, blade wear and mixing capacity.

(b) Are timing devices provided on stationary or paving mixers and are they interlocked with the discharge mechanism?

(c) Are truck mixers, if permitted, equipped with accurate revolution counters?

(d) Are batch-counters provided?

(e) Check water batcher on paver for accuracy.

(f) Check air-entraining admixture dispenser on paver for accuracy. Is it interlocked with batching and discharge of water?

(g) Is the paver skip in good condition, of adequate dimension to handle the dry-batch without spillage and provided with protective guards?

(h) Do the boom and bucket on the paver comply with specification requirements?

(i) Has a drag sled been provided for attachment to the paver to collect mixer discharge spillage?

(5) Check batch hauling units.

(a) Check for general condition.

(b) Make sure that batch compartments are weather-tight.

(c) Are the batch compartments of sufficient size so that spillage will not occur from one compartment to another either in loading or discharging?

(d) Are the gates between compartments tight and equipped with adequate locking devices?

(e) Do the units comply with requirements under the option chosen for transporting the batch to the mixer, (a) separate compartments for cement? (b) mixing the aggregates and cement?

(f) If back-up alarms are required, see that they are provided and maintained in operating condition.

(6) Check paving equipment and tools.

(a) Is all paving equipment on the job and in good operating condition?

(b) Have the machines been adjusted and checked for accuracy of strike-off, screeding, and floating?

(c) Do the vibrators comply with specification requirements?

(d) Check hand tools such as edging tools, hand floats, and straight edges for required dimension and condition.

(e) Are all necessary materials and equipment on hand for curing the pavement?

(f) Is all necessary equipment for construction or forming of all types of joints on hand and in good condition?

(g) Is adequate equipment on hand for sealing joints?

(h) Has the contractor provided and set up adequate facilities for making and curing test beams?

(7) Check base course surface preparation as follows:

(a) Is approved equipment being operated in a manner to properly fine-grade the base course?

(b) Is the base course prepared to produce a smooth, compacted surface conforming to grade and smoothness requirements?

(c) Is the base course surface being maintained in a firm, moist condition?

(d) If paving is carried on during cold weather, is the base course being properly protected against freezing and have you checked to insure that base materials are entirely free of frost when concrete is placed?

(e) Is base preparation and form setting being performed sufficiently in advance of concrete placement? Note minimum specification requirement.

(8) Prior to setting forms, determine that the surface of the base course has been constructed to or slightly above required grade and that the material meets all test requirements.

(9) Check forms.

(a) Are the forms identical in all respects to the form or forms approved for use on the work?

(b) Are the forms free of warps, bends, and/or kinks and are they free of battered top surfaces and distorted faces and/or bases? Remove damaged form sections from the project.

(c) Check forms as they arrive on the job site. Straightedge tops and vertical faces of forms after setting for deviations. Sight along forms to detect major deviations from true alignment.

(d) Check dimensions, position and securing of the metal keyway forms. Keyways must be exactly as detailed on the contract drawings.

(e) Does the base of each form section have full bearing for its entire length and width on fully compacted material?

(f) Be sure that form pins are of adequate length, are properly wedged in the pin pockets, and that they are free from mushroomed heads.

(g) Check locking devices between form sections for secureness and freedom from looseness or play.

(h) Determine that forms have been set to required grades. If correction of grade is necessary, remove form sections, adjust the grade and thoroughly recompact base material prior to resetting forms.

(i) Properly clean and oil forms after each use.

(j) Set forms well in advance of paving operations.

(10) Check sub-grade between forms.

(a) Check to see that subgrade, base course, or filter course is free of foreign matter, waste concrete, cement, loose aggregate or other debris.

(b) Check contractor's scratch template and template operation to assure that the rods are obtaining the required results.

(c) Check the prepared surface with the approved scratch template immediately ahead of the paving operation.

(d) Check the setting of the rods on the scratch template to insure that proper thickness of concrete will be obtained.

(11) Check embedded items.

(a) Are dowels provided of the required diameter (or diameters) and length (or lengths)?

(b) Are dowels clean, straight, and smooth with ends free from burrs or distortion?

(c) Is the dowel basket and/or expansion joint assembly identical to the basket approved for the project?

(d) Have means been provided for anchoring the dowel assembly securely in its required position?

(e) Has a template been provided for checking dowel position?

(f) If reinforcing steel is required, check type, dimension and cleanliness. Also check spacing, clearance, and method of securing in place during the paving operation.

(g) Check tie-down anchors and, if grounding electrodes are required, see that they meet the specified resistances.

(h) Check all other embedded items for location and proper installation.

(12) Check area and grade control.

(a) Determine that adequate plans for area and grade control have been formulated by the contractor and that plans have been made for checking the contractor's control of the grades of the concrete as placed.

(b) Be sure that control is set up to maintain pavement joint alignment.

(c) Determine that all utility lines within a paved area have been properly referenced so their position may be readily re-established if necessary.

b. Inspections During Paving

(1) Batch Plant

(a) Check identifications of cement shipments received to determine that it is tested and approved material.

(b) Check temperature of cement.

(c) Check handling and storage of cement for complete protection from exposure to moisture. Be sure that older cement is used first and that any cement in storage for more than four months is retested and approved prior to use.

(d) Make weight checks of bag cement.

(e) Check aggregate and aggregate handling as follows:

1. Check stockpiling methods to insure that segregation or contamination of materials is not occurring. Operation of bulldozers or hauling equipment on stockpiles is not permitted.

2. Observe and test aggregate for grading, moisture content, and cleanliness to determine acceptability, possible changes in quality and major differences from materials originally submitted as representative and approved.

3. Check handling of aggregate into the batch plant bins to see that there is no spillage or mixing of the different aggregate sizes, and that there is no other undesirable material.

(f) Compare batch volume with computed volume for the day's run. Report significant variations to your supervisor.

(g) Make periodic checks of cement and aggregate scales for accuracy and proper operation. Make similar checks of water batchers and air-entraining agent dispensers if the plant includes these facilities.

(h) Check batch counters and recorders for accuracy of recording and otherwise satisfactory operation.

(i) Check mix design computations. Adjust for aggregate surface moisture and size of batch employed.

(j) Check scale settings for each material batched.

(k) If a central mixing plant is employed, check mixers for mixing efficiency, rate of drum rotation, mixing time, and proper setting and operation of locking devices to provide the required mixing time.

(l) Check batch hauling units to see that there is no loss of aggregate or cement, or overflow from one batch compartment to another during loading.

(m) Check batch plant and related equipment and its operation for compliance with all safety requirements.

(2) Paving Operations

(a) Check paver and paver operation for:

1. Accuracy of batching from water-batcher.

2. Leakage of water batching system, particularly at valves.

3. Air-entraining agent dispenser's accuracy of batching.

4. Satisfactory operation of required interlock between water batcher and air-entraining agent dispenser.

5. Timing device setting and operation to insure concrete is mixed for the required length of time.

6. Proper operation of batch counter.

7. Cleanliness of mixer drum and wear of mixer blades.

8. Proper loading of mixer skip and spillage of batched materials.

9. Unnecessary spillage of mixed concrete.

10. Control of discharge from paver bucket to effect reasonably uniform distribution of concrete on the prepared base course.

(b) Check placing, spreading, and vibration of concrete as follows:

1. Slow down or stop placement of concrete if for any reason subsequent operations lag behind sufficiently to affect the quality of the concrete.

2. Be sure that concrete placement and vibration in the vicinity of embedded items is performed in such manner that they will not be disturbed. Transverse dowel assemblies should be covered by hand shoveling concrete.

3. Adjust spreader to strike-off concrete at a level such that when vibrated, the proper amount of concrete will remain for the finishing machines.

4. In the case of reinforced pavement, adjust spreader to strike-off concrete at the proper depth.

5. Check that rubber-tired wheels are installed on the spreader when the wheels are operated on a previously constructed slab. Make sure the slab is strong enough to support traffic.

6. Check operation of vibrators for effectiveness in consolidating the concrete. Check frequency of vibration and that they are operated at proper depth and that vibration is completely effective including vibration along the forms. Do not allow vibration in one location for more than 20 seconds' duration.

7. See that an extra vibrator, or sufficient parts for replacing and repairing a vibrator, is maintained on the job.

8. Prevent workmen from unnecessarily walking in fresh concrete.

(c) Check embedded items as follows:

1. Reinforcing steel, if required, must be of required size and spacing, properly cleaned, and set in the required position.

2. Reinforcing steel mats must be lapped. Be certain that the reinforcing is not extended through a pavement joint.

3. Is one end of each dowel painted and greased?

4. Are the dowel assemblies being maintained in correct position and alignment during placement and finishing operations?

(d) Check machine finishing as follows:

1. Periodically check adjustments of the transverse and longitudinal finishing machines. Need for change of adjustments may be determined by visual observations and straightedge and/or string-line checks of the pavement surface left by the machines.

2. Forward screed of transverse finisher should carry a uniform roll of concrete of about 4 to 8 inches in diameter; rear screed should carry a uniform roll of concrete of about 2 inches in diameter.

3. If transverse finishing machine produces a slurry ahead of the screed after the first pass, concrete mix should be adjusted. Slight reduction of water will often correct this condition.

4. Transverse finishing machine should leave the concrete surface at proper grade and essentially to proper smoothness.

5. Longitudinal finishing machine is not designed for major cutting and shaping of the concrete surface. Use for correcting relatively minor surface irregularities and smoothing the concrete surface.

6. Check that float makes required lap as longitudinal finisher advances its position.

7. In some cases of relatively steep transverse grades, better results may be obtained by operating the longitudinal float "uphill" only.

8. If longitudinal float carries wet mortar, do not raise float blade until mortar is discharged outside the form.

9. If longitudinal float does not

maintain complete contact with the concrete surface as it travels across the paving lane, add fresh concrete and refloat.

10. Finishing machines in proper adjustment will produce a surface requiring a minimum of hand finishing.

(e) Check hand finishing as follows:

1. Use hand-manipulated floats sparingly. Hand floating should be necessary only to remove local surface irregularities.

2. Majority of hand-finishing should be performed with straightedges. Straightedge is not a heavy-duty cutting tool. Its purpose is to remove minor surface irregularities and score marks.

3. Check all straightedges for trueness.

4. Check surface of plastic concrete with a straightedge including check across longitudinal joints as straightedge finishing is completed. Surface of plastic concrete must fit straightedge without deviation except at crowns and other planned breaks in grade.

5. Final surface finish is generally required to be produced by burlap dragging.

6. Timing of burlap dragging is important to produce the required surface texture. Drag when most of surface sheen has disappeared but while the concrete at the surface is in a plastic state.

7. Be sure the burlap drag is constructed and operated as required and that it is kept moist and clean.

8. Joints requiring hand tooling should be carefully formed. Check that edging tools are of required dimension and that the edging tool is not tilted during tooling of the joint or otherwise improperly manipulated to result in surface irregularities at the joint.

9. Do not permit use of soupy mortar to fill out depressions along joints during hand tooling; use fresh concrete.

10. Check that all spillage of grout and concrete on adjacent concrete surfaces is cleaned up immediately. Particularly watch for removal of mortar accumulations on radius and sides of that

part of a longitudinal joint formed in the previously placed, adjacent lane.

11. Eliminate tool marks by burlap dragging along joint with a small, hand-operated drag.

12. Filler-type or sawed transverse contraction joints are generally required. It is important to insert or cut the joint at the correct time.

13. Install filler strip of filler type joint exactly as specified. Check that the filler strip as installed is properly aligned, is vertical, and is set flush with or slightly below the pavement surface.

14. Carefully observe finishing in the vicinity of the filler-type joint and immediately after finishing, check across the joint with a straightedge. If depressions are found, fill out with freshly mixed concrete and refinish the surface.

15. Recommend inserting nails in the center of the filler strip at each side of the lane to assure continuous joint alignment and positively locating filler strip at the time of subsequent sawing.

16. Carefully check the grooving or crimping operation. Check width and depth of grooves.

17. Re-check pavement with a straightedge upon completion of finishing while concrete is plastic and make necessary corrections.

18. Dowel transverse construction joints as required and carefully construct to result in a properly aligned and smooth joint.

(f) Check curing as follows:

1. Make sure that effective curing is maintained for at least seven days.

2. Check to see that unhardened concrete is always protected from rain and flowing water.

3. Make sure that the necessary materials and equipment for the curing are on the job prior to beginning the paving operation. See that necessary stand-by equipment is also at the site.

4. Check that curing procedures are suited to prevailing climatic conditions.

5. Make sure the method of curing used provides complete and continuous protection of the concrete against cracking.

6. When forms are used, check within one hour after removal to see that sides of slabs are protected.

7. Check the initial curing for proper method, timely application and duration.

8. Check final curing for type of covering used, method of applying the covering, and wetting of surface before the application of one of the optional coverings specified.

a. Check weight of burlap and lap of edges.

b. Check the wetting operation.

c. Check method of holding down the waterproof paper blankets and the cementing or taping operation. Make sure continuous cover with completely closed joints is provided.

d. Check for any later tears and timeliness and method repairing.

e. Check application of curing compound. The compound is not to be sprayed on a dry surface and must be applied at the proper time.

f. Check machine used to apply membrane. It should be automatic, self-propelled, able to provide continuous and uniform coverage of compound of the same consistency.

g. Check for overlap coverage to assure that two-coat application is being obtained and the coverage is no more than 200 square feet per gallon for both coats.

h. Carefully check for any discontinuities, pin holes or abrasions and have these places corrected immediately.

i. Check that joints to receive joint sealing are protected from membrane curing.

8. Check for any special requirements for curing concrete placed during cold weather.

(g) Pavement Protection - See that curing compound or covering is protected during the curing period. Check on the erection and maintaining of barricades to exclude all unnecessary traffic from the pavement for at least 14 days after the concrete paving.

(h) Jointing of old pavement to new.

1. Check for continuous bond between old pavement and freshly placed pavement.

2. Check surface against which the new material is to be placed. It should be clean and properly coated with the material specified.

c. Inspections Subsequent to Paving

(1) Form Removal - Do not permit removal of forms until minimum time after placement has elapsed. See that proper care is exercised to prevent injury to the concrete by form removal.

(2) Sawed Joints (if Specified)

(a) Determine that sufficient equipment is on hand and that satisfactory provisions have been made to carry on the sawing operation day or night as necessary.

(b) Determine that alignment of joint is properly established prior to sawing to assure straight and continuous joints.

(c) Determine proper time for sawing by field trial. Sawing should be performed as soon as the concrete may be cut without excessive tearing and raveling of the concrete and without undercutting or washing at the sides of the cut.

(d) Check width and depth of cut.

(e) Thoroughly flush saw cut and adjacent concrete surface with water immediately after each cut is made.

(f) Examine concrete surface in vicinity of planned joint location prior to sawing. If an uncontrolled crack has occurred, do not permit sawing of the joint. Discontinue sawing if crack forms ahead of the cut during the sawing operation.

(g) See that curing coverings removed to permit sawing are replaced immediately after each joint is sawed.

(h) If curing compound is used, check to see that joints are cured as specified and that curing compound does not enter the joint.

(3) Other Joint Sawing

(a) Saw filler type joints to width and minimum depth required. Carefully examine sides of cut to be certain that all traces of the filler strip have been removed.

(b) Check to see that all construction joints, longitudinal and transverse, are sawed out to the required joint dimensions prior to joint sealing.

(4) Prefabricated-metal-form-fillers.

(a) Make sure inserts are straight from edge to edge.

(b) Watch for ruptures in sheet metal during grooving.

(c) Check depth and width.

(d) Examine operation for ravels and spalls in concrete.

(5) Joint Cleaning

(a) Check joint cleaning operation for required performance and sequence in preparation for joint sealing.

(b) Check to see that concrete saws, saw blades, sand blasting equipment and sand, air compressors, air nozzles and accessory small tools are available, suitable, and in good working condition.

(c) Check sand blasting operation to insure that the proper nozzle or nozzles are used and that they are positioned and aligned to obtain satisfactory results.

(d) Carefully examine final results to determine that the joint walls, joint bottoms, and 1/2-inch of adjacent pavement surfaces have been thoroughly cleaned and the joint is free of all foreign materials that would prevent bonding of the joint sealer to the concrete.

(6) Joint Sealing

(a) Determine that the correct type of joint sealing compound and the specified equipment for the joint sealer employed is being used.

(b) Do not permit sealing of joints under weather conditions outside specification limitations unless a waiver has been directed in writing by the Contracting Officer.

(c) Check that sealers are heated when same is required. If two component sealants are used, check that proportions in place are correct. Have contractor read and follow instructions on pails without exception. Check that placing equipment is suitable for materials used.

(d) Nozzle for sealer application must be of such dimension that it can be inserted well into the joint groove to effect filling the groove from the bottom up without formation of voids.

(e) Fill the joints flush with the pavement surface. Remove excess and spilled material from the pavement surface and waste.

(f) Maintain complete records of the sealing operation.

(7) Check surface smoothness of hardened concrete.

(a) Is the contractor straightedging the finished pavement in the specified manner and within the specified time?

(b) Check to see that the contractor is taking required action to correct deviations outside smoothness tolerances.

(c) If rubbing is performed to correct minor deviations during curing period, flush rubbed area with water and continue effective curing without delay.

(d) Straightedge-check the finished surface for acceptance or rejection of the pavement.

(e) If subsequent grinding of deficient pavement is approved, determine that limitations on area corrected by grinding are not exceeded.

(8) Finished-Grade Checks - Normally, finished-grade surveys will be made by a Resident Engineer staff survey party. The inspector should be familiar with survey results as he will be responsible for inspection of corrective work in the event deficiencies are found.

(9) Pavement-Thickness Checks - Pavements will be checked for thickness by means of coring. The coring program normally is set up and performed by the project laboratory but, as in the case of grade-checks, the inspector should be familiar with results.

(10) Pavement Deficiencies and Corrections

(a) When pavement areas are removed for replacement, check adjacent pavement for damage such as cracking, breakage of concrete at the edges, and damage to keyways or other load-transfer devices. Such damage may necessitate further concrete removal and/or correction of load-transfer -- consult your supervisor on such cases.

(b) Replacement slabs shall conform to minimum dimensional requirements and otherwise conform to all specification requirements.

(c) Most random cracks occurring in pavements may be repaired. If there is no provision in the contract for repair of such cracks, check with your supervisor. Be sure that specified and/or proper equipment is issued and that repair methods are very carefully followed in every detail.

d. Control Tests

(1) Aggregate

(a) Run sieve analysis of aggregate size at least twice daily for a full day's paving operation.

(b) Test for surface moisture at start of paving and periodically during each day's operation depending on changes in moisture condition.

(c) Organic-impurities test (color test) for each shipment of sand, or more frequently if deemed necessary.

(d) Specific-gravity test about weekly, or when visual check indicates a change in the material.

(2) Concrete

(a) Supervise the making of test specimens by the contractor. Take specimens at about 4-hour intervals. Determine slump, entrained-air content and temperature of concrete from same sample.

(b) Make and record periodic slump or Kelly Ball penetration tests and entrained-air tests during the day. Frequency should be consistent with uniformity of mix.

(c) Measure and record ambient air and concrete temperatures at hourly intervals.

(d) Determine that test specimens are cured and tested in strict accordance with standard procedures.

105-09. CONCRETE SIDEWALKS, CURBS AND GUTTERS

a. General - The construction of concrete sidewalks, curbs and gutters, in general, requires the same steps in inspection as a large scale paving operation to assure quality construction.

b. Sub-Grade and Base Course

(1) Check in-place materials and/or fill materials for bearing quality and compactibility, especially over utility trenches.

(2) Check results of rolling for firmness of compacted sub-grade. Check density as required or otherwise necessary.

(3) Check sub-grade for grade and cross-section. If sub-grade is prepared to receive concrete directly, check grade and cross-section with required template resting on side forms.

(4) If a base course is required, check materials, compaction, and surface grade and cross-section for conformity with requirements.

(5) Check moisture content of sub-grade prior to concrete placement.

c. Forms, Concrete Placement, Finishing and Curing

(1) Check forms for condition, cleanliness, rigidity and conformity with required dimension of the structure.

(2) Check form setting including full bearing of form bases on prepared sub-grade or base course, securing forms in place, adequacy of clamps, braces and spreaders as applicable, provision for removable form sections, adequacy of forms for curb returns, and aligment and grade.

(3) Check location, grade, and dimensions between forms.

(4) Check the oiling of the forms and the time the forms are to be removed.

(5) Check availability and adequacy of materials required to form contraction and/or expansion joints. Check location and spacing of joints.

(6) Check to see that concrete mix employed is the mix designed for the work being performed. Check slump and entrained-air content of the concrete.

(7) Check placement and consolidation of concrete to insure that segregation does not occur and that honeycomb does not result.

(8) Observe forming of contraction and expansion joints for proper installation and finishing of the exposed joint edges.

(9) Check that exposed surfaces are finished by required methods.

(10) Inspect tops and faces of curbs, surfaces of gutters and surfaces of sidewalks for conformity with surface smoothness and shape requirements.

(11) Assure that an approved curing method is employed and that the curing is performed in accordance with the method, and that curing is started immediately after the finishing operations. Check that curing is continuous for the required curing period.

(12) Verify protection of concrete against damage during backfill or other operations. Damaged concrete shall be repaired and/or removed and replaced as required.

(13) Check cleaning and sealing of expansion joints in curbs and gutters, and expansion and contraction joints in sidewalks. Clean joints thoroughly immediately prior to sealing, and fill joints with approved material using approved equipment. Require cleaning of surfaces where spillage has occurred or excess sealer has been applied.

105-10. PATCHING CONCRETE PAVEMENT WITH EPOXY

a. Materials

(1) Check both coarse and fine aggregate for conformance with requirements.

(2) See that Epoxy-resin has been approved and that the proper type is being used for the atmospheric temperature conditions.

(3) Verify other miscellaneous materials such as those to be used in curing, the Portland cement, air-entraining admixture, joint-sealing materials and water.

b. Storage

(1) Check aggregates to assure no breakage, segregation, or contamination by foreign material.

(2) Check the Epoxy storage area to see that it is windowless, weatherproof, ventilated, insulated, and noncombustible. Also check to see that the material has been maintained at a temperature between 70 and 85 degrees F. for 48 hours prior to use.

(3) Check for cement being maintained dry.

c. Mix

(1) Check for approval of mix.

(2) Check to make sure that control can be maintained.

(3) Continue to check result of mix for workability and strength.

d. Equipment

(1) Check for approval of all equipment which will be used in the operation.

(2) Check to assure that the equipment is being maintained in good working condition.

e. Preparation for Placement

(1) Check the removal of existing pavement to the depth specified and to a depth where concrete to be patched will be sound and unweathered.

(2) Check sandblasting where this operation is necessary.

(3) Check for removal of all joint filler and seal materials which will prevent bond between concrete and the patch.

(4) Assure that necessary fiberboard fillers are used to prevent the closing of any existing joints.

(5) In order to provide adequate bonding of old and new surfaces prior to placing of epoxy, check that the surface has been blasted with both a high-pressure water jet and by an air jet to remove free water.

(6) Observe the application of a thin film of epoxy resin grout on the freshly cleaned surface.

(a) Verify mixing of material for the grout.

(b) Check safety of the operation. Require full face shields, coveralls, and protective cream on workmen, and check adequacy of fire protection.

(c) Check thickness of film.

(d) Check number of coats.

f. Placing; check the following:

(1) Batching and mixing of materials.

(2) That the initial epoxy grout is still tacky when fresh concrete is placed.

(3) Handling and the placing of the concrete.

(4) Atmospheric and material temperature.

(5) Consolidation of concrete.

(6) The making of the necessary tests.

(7) Finishing and curing.

(8) Finished grade and alignment of joints to see that they match the grade and alignment of the adjoining surface.

(9) For protection of patched areas.

(10) The re-sealing of joints as required.

g. Safety

(1) See that all workmen are provided with:

(a) Rubber or neoprene gloves.

(b) Face shields or goggles.

(c) Protective creams.

(2) Insure that manufacturer's recommendations are followed.

(3) Fire protection should be provided during the epoxy mixing operations.

CHAPTER 106
GRASSING, PLANTING AND EROSION CONTROL
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CHAPTER 106
GRASSING, PLANTING, AND EROSION CONTROL

106-01. GENERAL

This chapter covers soil preparation, seeding, planting, and materials utilized therein. Erosion control as covered herein is applicable only as it pertains to the protection of areas subjected to grassing and planting.

106-02. MATERIALS FOR TOPSOILING, SEEDING AND MULCHING

a. Topsoil

(1) Check source of supply, and mark or stake specific areas within source.

(a) Secure sample prior to use.

(b) Require chemical testing.

(c) Obtain approval prior to application.

(d) Keep part of sample for future comparison.

(e) Determine depth for excavation.

(f) Check mechanical analysis or physical description.

(2) Check cleanliness.

(a) Check freedom from stones, sticks, subsoil, roots, weeds, etc.

(b) Check quantity of grass in topsoil when same is required.

(3) Compare delivered topsoil with sample.

b. Lime

(1) Check gradation.

(2) Check minimum percent of calcium oxide or magnesium oxide.

(3) Check label on bag and make sure that your supervisor has a copy of the invoices on all lime and fertilizer used on the job.

(4) Require test if discrepancy is evident.

(5) Obtain signed copies of invoice.

c. Fertilizer

(1) Check type and class required; pelleted or granular.

(2) Check label data when delivered.

(3) Obtain copies of signed invoices.

d. Seed

(1) Check seed tags for mixture, names, purity, germination, weed seed content, and date of last test. Determine pure line seed content when required.

(2) Check condition of seed for water, insect, and/or mold damage.

(3) Obtain statement of vendor.

(4) Require test if in doubt.

e. Mulch

(1) Obtain representative sample.

(2) Check type of material and length of herbage.

(3) Check for weeds.

(4) Check freshness.

(a) Expandable and springy - O.K.

(b) Discolored, brittle, damp rot, mold, or decay - REJECT.

(5) Obtain weight certificate on each load.

106-03. PREPARATION OF THE AREA TO BE TOPSOILED AND SEEDED

a. Compaction

(1) Check fill areas.

(2) Check trenches and slopes.

b. Clean-Up

Insure removal of debris, roots, and stones.

c. Sub-Grade Elevations

(1) Determine if required depth of topsoil can be placed and if proper drainage can be maintained.

(2) Check for drainage.

(3) Check edges of roads and walks.

(4) Where required, check depth and extent of excavation.

d. Scarify Sub-Grade

(1) Determine if tillage or scarification is accomplished to specified depth.

(2) See that topsoil is not applied over untilled or unscarified areas.

106-04. PLACING AND GRADING TOPSOIL

a. Placement

(1) Assure that even distribution is made over area at the specified depth.

(2) Avoid over-compaction. Keep passing equipment off topsoil.

(3) Check on grades and provide drainage of surface water. See that landscaping slopes away from buildings and other improved structures.

(4) Check on watering within specified limits when topsoil with grass is used.

(5) See that vegetated or paved flumes are installed for slopes on which erosion may occur.

(6) Check for matching seed bed below edges of walks and pavements.

b. Grading

(1) Check finished grade.

(2) Check light rolling, fine grading, raking, and depth of tillage, where specified.

(3) Check for even surface.

(4) Insure removal of debris, stones and roots.

106-05. APPLICATION OF FERTILIZER AND LIME

a. Distribution

(1) Check type and condition of equipment.

(2) Check calibration of equipment and record distributor settings for specified amounts.

(3) See that material is not applied more than 24 hours in advance of tillage.

(4) Check for even distribution, especially on slopes where distributor should be kept filled to not less than 1/2 of its capacity at all times.

(5) Check loss of fertilizer by high winds, and postpone application when necessary.

b. Quantity Check

Check the total quantity used against the acreage covered. Retain empty bags until the number is recorded.

106-06. TILLAGE

a. Equipment

(1) Check type and condition of equipment.

(2) Check spacing of plows or chisels.

b. Tilling

(1) Check depth of tillage measured from undisturbed surface.

(2) Check for cross-tillage where required.

(3) Inspect discing, harrowing, and smoothing.

(4) Observe whether there is an excessive amount of clods in seed bed and determine the necessity for discing and harrowing to provide an acceptable seed bed.

106-07. PLANTING SEED

a. Time of Planting

(1) Check progress schedule at start of job.

(2) Stay within specified periods.

(3) Permit planting "out-of-season" only with special approval.

(4) Check for removal of stones and other objects.

b. Application

(1) Check for even distribution and see if specified type of seeders are used.

(2) Check condition of equipment.

(3) Check rate. Make calibration tests and record drill settings for specified amounts.

(4) Check coverage of seed and depth of planting.

(a) Mechanical or hand.

(b) Check to see that topsoil is not firmly compacted, hard, lumpy, or stony.

(5) Check loss of seed during windy weather, and when necessary, postpone seeding.

(6) Retain empty seed bags and record amounts planted; compare against acreage.

(7) Check to see if signs and barricades are installed on seeded areas.

106-08. WATERING

a. Equipment

See if adequate specified equipment is on hand and useable prior to the beginning of sprigging, sodding, and topsoil planting.

b. Application

(1) Check on placement of equipment to obtain complete coverage.

(2) Look for waste of water and/or damage to areas.

(3) Check depth of water penetration.

(4) Determine if water is applied within 24 hours of starting of sprigging, sodding, or topsoil planting.

c. **Maintenance**

(1) See that area is frequently watered.

(2) Check area for required mowing.

(3) Determine that refertilizing, resprigging, resodding, and reseeding are done where specified.

(4) See that mulch is secured.

(5) Check for repair of erosion damage.

(6) Assure that final payment is not made to contractor prior to evidence of satisfactory grass growth.

106-09. APPLYING MULCH

a. **Application**

(1) Check rate. Weigh 3 to 5 bales for average weight. Determine number of bales per acre.

(2) Check rate of straw and asphalt emulsion used.

(3) Check looseness.

(4) Check depth.

(5) Check matting.

(6) Compare total of weight certificates against area mulched to determine if the mulch was applied at specified rate.

(7) Check kind of asphalt emulsion used.

b. Resistance to Blowing (Anchoring Mulch)

(1) Check method of securing to ground.

(2) Check the depth of anchoring mulch.

(3) Check equipment used to anchor mulch.

(4) Check effectiveness by moving mulch by hand to test stability.

106-10. SODDING

a. Sod Material

(1) Check type, health, coverage and height of grass in sod.

(2) Determine that area is relatively free from weeds, undesirable plants, large

stones, roots, or anything which would be detrimental to the development of grass or to future maintenance.

(3) Check type of soil to determine if soil will adhere to grass during harvesting and handling.

b. Fertilizer and Lime

Make similar check as mentioned under "Application of Fertilizer and Lime", 106-05.

c. Application of Fertilizer and Lime and Preparation of Sod Bed

Make similar check as mentioned under "Application of Fertilizer and Lime", 106-05.

d. Procuring and Placing Sod

(1) Make certain that rectangular sections of sod have uniform widths and retain native soil on roots and that the thickness is as specified. Check sod cutter.

(2) Examine handling, stacking and care of sod.

(3) Check time between cutting of sod and placing.

(4) Check sod to assure that it is in a moist condition.

(5) Make certain that sod is placed at a favorable time with respect to weather and season and that it is laid in a staggered formation.

(6) Check the tamping or rolling of sod into prepared sod bed.

(7) Check the filling of cracks between sod with good quality, screened soil.

(8) Check requirements for placing strip and spot sod.

(9) Make sure sod is kept adequately wet.

(10) Make sure that sod is securely anchored by means of wooden pins where required.

3. Maintenance and Repair

(1) The contractor is not finished with the sodding until it is accepted by the engineer.

(2) Check for any necessary maintenance and repairs.

106-11. TERRACING

a. Equipment

Check the equipment used in terracing.

b. Layout and Construction

(1) Check location, grade, and outlets.

(2) Check cross-section for agreement with details on plans.

c. Maintenance

Check the maintenance of terracing.

106-12. PLANTING TREES, SHRUBS, VINES, GROUND COVER

a. Plants

(1) Check for certificate of inspection. Do not accept plants without certificate.

(2) Check quality and size against the rules and grading standards included in the American Standard for Nursery Stock, in the legend on the drawings, and as described in the specifications.

(a) Check range in each size group.

(b) Do not accept smaller than required.

(3) Check root system, and reject all plants on which the roots have been allowed to dry out or which have been damaged.

(4) Check foliage for wilt or dryness.

(a) Reject plants with wilted leaves.

(b) Reject plants with evidence of disease or insect damage.

(5) Balled and burlapped plants.

(a) Check for a solid ball in conformance with specified dimensions.

(b) Reject plants with balls broken, cracked, soft, or pliable.

(6) Bare root plant.

(a) Make certain that plants are dug when fully dormant, and that they are heeled out and watered immediately upon arrival.

(b) Check size of root spread against requirements in American Standard for Nursery Stock and in plant legend on drawings.

(c) See that roots contain a mud coating.

(d) Check for broken roots, and see that they are removed by pruning.

(e) Check foliage for fullness and for conformance with the variety.

(7) Container-grown plants.

(a) Check length of time plants have been grown in pots, cans, tubs, or boxes, and check the size of container.

(b) Check root system when removing plants from container, and assure that soil adheres to roots.

(8) Method of shipment.

(a) See that plants are covered in transit, and that they are handled as specified in loading and unloading.

(b) Check on damage.

b. Material Other Than Plants

(1) See that all material has been approved before the planting operation is ready to begin.

(2) Check burlap for type, weight and resistance to tearing.

(3) Check fertilizer in the manner previously described in grassing.

(4) Check for approval and test results on manure used, and check quality, age, and for presence of noxious weed seed.

(5) Check wires, stakes, braces and deadmen for type and size.

(6) Check mulch and topsoil as previously outlined under grassing.

(7) Check physical condition, cleanliness, and source of peat.

106-13. PLANTING OPERATION

a. Layout of Major Planting

(1) See that layout has been made.

(2) Check for conflict with utilities or underground structures and ditches, and have plants relocated where necessary.

b. Planting Dates

Check dates on which plants should be planted.

c. Excavations

(1) Check depth.

(2) Check diameter.

(3) Check spacing and depth for plants in beds.

(4) Check for proper handling of topsoil.

d. Planting

(1) Check grade of beds and fill.

(2) Check soil moisture being placed under and around plants.

(3) Check placing and tamping of topsoil.

(4) Check stability, handling, and placement of all plants.

(5) Check stakes or guys.

(6) Check moistness of planting beds.

(7) Check wrapping and pruning after planting.

(8) Check mulching operation; depth and coverage of pits and beds.

106-14. MAINTENANCE

a. Establishment

(1) Check watering.

(2) Check pruning.

(3) Check spraying.

(4) Check weeding.

(5) Check appearance.

(6) Initiate corrective action for wilted, dried out, unhealthy, or diseased plants. Note location of such plants on drawing.

b. Replacement

Check for timely replacement of plants.

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CONCRETE FOR STRUCTURES
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CHAPTER 201
CONCRETE FOR STRUCTURES

201-01 GENERAL

This chapter covers commonly encountered concrete work other than concrete paving, which is covered in another chapter. Specialized procedures such as pumpcrete, pressure grouting, shotcrete, replaced aggregate concrete, etc. are not covered.

Inspectors are cautioned that the contract requirements for concrete for a given job are contained in the drawings and specifications prepared for that job. Also, that contract requirements may change from job to job. This guide should therefore be used in conjunction with, and not instead of, careful reading and rereading of the specification requirements for the individual job.

201-02 RECORDS

a. Check with your supervisor and be sure that you know what records you will be required to keep.

b. Enter the required information accurately, completely and promptly in these records.

201-03 MATERIALS

a. Sources

(1) Check before starting concrete work:

(a) Has contractor given advance notice of sources of materials?

(b) Have samples been furnished?

(c) Have mixes been established.

(d) Have tests been completed on air-entraining agent? On curing compound? Concrete placement conditions may be such as to require admixture other than air-entraining agent or calcium chloride. Has this admixture been tested and approved? Reduction of cement content for basic design mix is not permitted.

(e) Have shop drawings for steel reinforcement and embedded items been approved?

(f) Does the aggregate meet the contract requirements?

(2) Check as work proceeds. Are test reports, mill certificates or other certificates of compliance on hand for all materials being used?

b. Storage and Handling

(1) Cement

(a) Is cement transported from the mill to the mixing plant in weathertight containers?

(b) If intermediate storage is involved, is cement adequately protected from exposure to moisture during intermediate storage and in loading and unloading operations?

(c) Is storage at mixing plant weathertight and properly ventilated?

(d) Is sufficient storage capacity available?

(e) Is oldest cement used first?

(f) Has over-age cement, if any, been tested?

(g) If concrete supplier has other customers, are adequate precautions taken to see that cement tested and approved for your job by the Bureau of Standards is not being used in concrete delivered to others? That untested cement is not being used in concrete delivered to your job?

(h) Have arrangements been made to secure all cement from one manufacturer?

(i) Is the cement being used in the same sequence as it is being delivered?

c. Miscellaneous Material

(1) Have the necessary materials such as inserts, slots, clips, anchor bolts, etc. been approved and are they on the job site prior to starting the concrete placement?

(2) Has contractor received approval on materials he will use for capillary water barrier, vapor barrier, water proofing, reinforcing steel, expansion joints material, joint sealer, forming, curing, etc.?

(3) Stockpiles

(a) Are aggregate stockpile areas graded, drained and stabilized so that contamination will not occur?

(b) Are aggregate stockpiles separated so that inter-mixing does not occur? Are they built up to avoid segregation and contamination?

(c) Are aggregates conveyed from stockpiles to batching equipment by means which will avoid segregation and inter-mixing? Do not allow use of bulldozers or similar equipment.

(4) Water - Is the supply of water for mixing and curing protected against contamination?

(5) Admixtures

(a) Is air-entraining admixture protected against freezing during storage?

(b) Has over-age admixture, if any, been retested?

(c) Check accuracy of dispenser and correct dispersion of admixture.

201-04. BATCHING AND MIXING

a. Equipment

(1) Are batch truck compartments free of leaks, with bulkheads high enough to prevent overflow?

(2) Do compartment gates and water valves close tightly?

(3) Are contractor-furnished test weights on hand

(4) Check all scales and measuring devices.

(5) Are these checks repeated periodically, as frequently as necessary to insure that delivery of materials from the batching equipment is kept within the specified limits of accuracy?

(6) Are automatic cut-off devices adjusted so that accuracy of batching is kept within the specified limits?

(7) Check recording devices to see that the recorded weights are the same as the scale settings. (These should be checked at least daily--more frequent checking and adjustment may be necessary to keep this equipment recording accurately).

(8) Check batch sizes so that mixers will not be loaded beyond manufacturer's rated capacity.

(9) Is plant equipped with all required interlocks, in operating condition?

(10) Is dispenser for air-entraining agent arranged so that the agent is batched with the water? (Specifications may provide that where use of truck mixers makes this impracticable, the admixture may be batched with the sand. This applies only in the case where the water is batched on the trucks. When the water is batched at a central batching plant, it is not impracticable to batch the admixture with the water. In this case, the fact that truck mixers may be used to mix and transport the concrete will not relieve the contractor from the requirement for batching the admixture with the water.) If admixture other than air-entraining agent is approved, ensure that the admixture is introduced separately in a portion of the mixing water.

(11) Check multiple-batch trucks used for dry batching. Are compartments of ample size and are gates tight so that there is no overflow or leakage between compartments? (Check when truck body is raised to highest dumping position.)

(12) Is mixing drum watertight?

(13) Are mixing drum and discharge chute clean and free of hardened concrete?

(14) Check mixing blade wear.

(15) Do water valves operate easily and shut off tight?

(16) Check revolution counter provided on each truck mixer.

(17) Is mixer equipped with discharge lock, adjusted so that required mixing time elapses? (Note that specified mixing times are minimum, and that additional mixing may be required if necessary to produce complete, uniform mixing.)

(18) Check mixer drum rotation speed as designated by the manufacturer.

b. Batching and Mixing Operations

(1) Check mixing time.

(2) Continually check for assurance of complete control over batching and mixing. Check volumes of material used in mix, mixing time, and other controlling features.

(3) Check moisture content of aggregates frequently. Adjust batch weights in accordance with variations in moisture content.

(4) Check gradations of aggregates frequently.

(5) Check visually the freshly mixed concrete (constant observation is desirable if inspection personnel are available) to see that uniformity is maintained.

(a) Any marked change from normal consistency or appearance indicates something wrong with the batching or the mixing, and the concrete should not be accepted for placement.

(b) Record rejected batches carefully, with reasons for rejection, and report promptly to your supervisor.

(6) Check slump and entrained air content as often as necessary to provide record data prescribed by job policy, and oftener if necessary to confirm visual checks.

201-05 PRE-PLACEMENT INSPECTION

Check all of the following prior to each placement--placing should not be permitted to start until all are satisfactory.

a. Materials on Hand - Are sufficient quantities of all materials on hand to permit continuous placement and completion?

b. Foundations

(1) Have location, dimensions and grade been checked?

(2) Has fill and/or capillary water barrier been compacted?

(3) Are foundation excavations free from frost, ice or mud; moist as required; free from standing or running water?

(4) Has paper or felt covering been applied and is it lapped and sealed?

c. Forms

(1) Check form materials.

(2) Check to see that re-used form materials have been reconditioned as required.

(3) Check location, dimensions and alignment.

(4) Is construction mortar-tight; smooth; free from offsets and blemishes?

(5) Are ties and bracing adequate to maintain position, shape and alignment of form?

(6) Are temporary spreaders arranged so as to be easily removable as the concrete rises in the form?

(7) Are ties installed so that they may be withdrawn or broken off to leave no metal closer than the specified minimum distance from the concrete surface?

(8) Have forms been oiled, wetted or sealed? Check to see that surplus oil has been removed from forms and that there is no oil on steel reinforcement, construction joints or other surfaces where bond is required. Are forms clean prior to placing concrete?

(9) Check forms for movement which may occur during placing operations. Have measuring devices or reference lines been set up?

(10) Are all required chamfer strips (or grade strips for flush joints) accurately aligned and securely fastened and protected?

(11) Have necessary clean-outs been provided for in the bottom of the forms?

d. Joints

(1) Are all joints (expansion, contraction, construction) located as shown on contract drawings or as otherwise approved? (The criteria governing the locations of joints not shown on the contract drawings are beyond the scope of this guide. Unless the inspector is fully instructed in these criteria and has been specifically authorized to select or approve the locations of joints, he must look to his supervisor for instructions as to the locations of joints which do not appear on the contract drawings.)

(2) Have construction joints been prepared as required? Check requirements for air-water cutting, wet sand-blasting, roughening, wetting, etc.

(3) The location of bulkheads in structural members, such as beams or slabs, should be checked with your supervisor.

(4) Have contraction joints been coated with approved material to break bond?

(5) Has filler been installed and securely fastened in expansion joints?

(6) Are expansion joints free from irregularities or debris which would interfere with free movement?

(7) Check all joints which are intended to allow for expansion or contraction. No reinforcement or other fixed metal will be continuous through the joint.

(8) Are water-stops firmly secured in correct location, undamaged and spliced properly?

(9) If contractor has the option of sawing certain joints after the concrete has set, and intends to exercise this option, have positive arrangements been made to have the locations of the joints laid out accurately, and to have approved sawing equipment and

qualified operating personnel available at the proper time?

(10) Are the horizontal construction joints clean and damp prior to placing grout or concrete?

e. Reinforcement

(1) Is all reinforcement in place in accordance with approved shop drawings? Check bar diameters, bar lengths, lengths of splices, bar-to-bar spacing and clearances.

(2) Watch for specialty items such as wall intersection bars, addition bars at corners and openings.

(3) Has reinforcement been cleaned of all loose, flaky, rust and scale, dried concrete, oil, grease or other foreign material which would reduce or prevent bond?

(4) Is reinforcement tied and supported securely so that displacement will not occur during concrete placement?

(5) Are reinforcement spacers, ties, plastic covered chairs, and supports as specified or approved?

f. Embedded Items

(1) Unless otherwise provided or approved, embedded items are to be fixed firmly in correct

location before the concrete is placed and are to be embedded by placing the concrete around them. "Boxing out" to permit subsequent "grouting in" of embedded items will not be permitted unless specifically called for by the drawings, specifications or special approval.

(2) In case of a conflict in locations of embedded items with each other or with steel reinforcement, the relocation of embedded items or cutting, bending, addition, displacement or omission of steel reinforcement will not be permitted except as approved by your supervisor.

(3) Are all embedded items in place? Check mechanical and electrical drawings and approved shop drawings for mechanical and electrical equipment, for requirements for anchor bolts, piping, sleeves, conduits, boxes, etc. which do not often appear on architectural and structural drawings.

(4) Are embedded items protected against damage during or subsequent to placement of concrete? Examples: Bolt threads and machined or polished surfaces covered; light metal sleeves or boxes braced internally; open pipes or conduits capped or plugged.

(5) It is often helpful to use checklist when checking for embedded items.

g. Miscellaneous Preparations

(1) Have satisfactory arrangements been made to get concrete into all parts of the placement without segregation, loss of ingredients, formation of air pockets or cold joints, vertical drops in excess of permissible limit, "running" of concrete by means of vibrator, and within the maximum time allowed after mixing?

(a) Is conveying equipment (i.e., crane, buggies, truck mixers, pumpcrete pipe, etc.) capable of reaching all parts of the placement?

(b) Are temporary form openings, tremies, chutes, conveyors or other special equipment provided as necessary and approved?

(c) Are "pockets" vented so that air will not be trapped?

(2) Are sufficient personnel available?

(3) Are all necessary tools on hand and in working condition? Check especially: vibrators, including standby; finishing tools.

(4) Have arrangements been made, and is all necessary equipment on hand and in working order to provide curing and protection (including cold weather protection if needed)?

(5) Are safe access and footing provided by means of ladders, platforms, walkways

and stagings.

(6) Review the testing plans to be made at the concrete plant and placement area during placement operation.

(7) The rate of placing the concrete will be directly dependent upon the adequacy of the preparations. If it is not clearly evident that the preparatory work is such as to insure placement of each batch of concrete within the specified time after mixing, and at such a rate as to prevent the formation of cold joints, the placement should not be permitted to start.

(8) Has the contractor made arrangements to make cylinders or beams to test the strength of the concrete at least once a day, and have provisions been made to properly make, handle, and cure the specimens.

201-06 CONVEYING AND PLACING

a. Equipment - See "Miscellaneous Preparations" under "Pre-Placement Inspection".

b. Operations

(1) Check requirements pertaining to placing fresh concrete on concrete which

has set. It may be required that the old surface be covered by a layer of fresh mortar, or that the old surface receive a slush coat of neat cement grout followed by specified topping.

(2) Is the time between completion of mixing and placement in final position in the form within the maximum allowed by the specifications?

(3) Check method of placement in handling of concrete, to prevent segregation, height concrete is allowed to drop freely, and method used to guide concrete into place.

(4) Is concrete placed rapidly enough to avoid formation of cold joints?

(5) Are layers maintained approximately horizontal and not exceeding specified thickness?

(6) Are form ties and supports checked frequently and adjusted as necessary to prevent or correct movements of the form?

(7) Is rate of placement within safe limits, such that forms will not be overstressed by too-rapid rise of fluid concrete?

(8) Check to see that a period of one to two hours is allowed for concrete in columns, piers and walls, and alongside such items as

built-in window frames, to permit the concrete to settle before placing concrete above them.

(a) Do not allow initial set to take place before placing the concrete above.

(b) The initial set period will be shortest during hot weather.

(9) Is each layer of concrete vibrated until fully consolidated?

(a) Insert vibrators vertically, through the full depth of the layers, at uniformly spaced points so circles of visible influence of the vibrators overlap.

(b) Do not allow vibration to be overdone to the extent of promoting segregation, and remember that vibrators are not to be used to transport concrete in the forms.

(10) The use of form vibrators is prohibited by some specifications and permitted by others, subject to specific approval. Do not allow their use except as approved.

(11) Check use of hand compaction tools insofar as practicable to assist in obtaining smooth, dense surfaces.

(12) Do not allow excessive working of the concrete surface in completing a lift--

only enough to completely embed the coarse aggregate.

201-07. REMOVAL OF FORMS

a. Inspection practice

(1) Is care being taken to assure that concrete is sufficiently hard and strong before removal of forms?

(2) Check to see that forms used for curing are left in place until expiration of required curing period. Forms shall be tightened and maintained "snug" against concrete surfaces at all times while using as curing media.

(3) For best patching results, forms should be removed as soon as practicable and patching should be immediately accomplished so that patches cure with parent concrete.

(4) Are you certain that all wood forms are being removed, especially in hidden places?

b. Method of Removal

(1) Is spalling of concrete being avoided during the form removal operation? Use methods which will avoid spalling, chipping, and gouging.

(2) Are safety practices being completely exercised during the form removal?

201-08. FINISHING

a. Formed Surfaces

(1) Check the type of finish required.

(2) Has the contractor constructed and received approval of sample panels to show the surface finishes required? Note that the placing of concrete represented by each sample is not to proceed until sample panel has been approved.

(3) Repairing of defective areas and removal of fins, forms marks and holes are required to be done immediately upon removal of forms.

(4) Check the cleaning of areas to be patched. Have honeycomb and rock pockets been cut back to solid material? Has loose material been removed.

(5) Check the requirements for the treatment of areas containing defective concrete.

(6) Check for complete curing of patched areas.

(7) Check surfaces for specified smoothness tolerances. Require rough areas and high spots to be ground smooth.

b. Unformed Surfaces

(1) Check the type of finish required.

(2) The working of the concrete surface should be the minimum that is necessary to produce mortar which is just sufficient for finishing.

(3) Insure that the screed runs are set to grade.

(4) Check to see that floating is started as soon as the screeded surface has stiffened sufficiently to permit floating without drawing excessive mortar to the surface. (There should be no free water on the surface at the start of floating. Dusting with cement or other material to dry the surface or to enrich the mortar will not be permitted.)

(5) Troweling, if required, should be done as soon as the floated surface has hardened sufficiently to prevent drawing more mortar to the surface, but while the surface is still workable.

(6) Check to see that marks left on the surface by edging tools are erased by floating, troweling or other means to produce a finish matching that of the adjacent surface.

(7) Insure that the screed run supports are removed to proper depth, if they are metal, and in their entirety, if wood is used.

(8) Make sure the screed runs are filled with good concrete and compacted.

(9) Straight-edge the plastic concrete after filling screed runs, just prior to initial flooding.

(10) Check the surface for smoothness tolerance.

c. Smooth Finish

(1) Check the contract specifications for areas requiring a smooth finish.

(2) Make certain that cement grouting operation is not delayed, allowing the grout to age with the concrete.

(3) Has the contractor planned his operations whereby he can completely finish areas to natural breaks in the finished surface each day?

(4) Has the proper mixture of cements (regular and white) been used in the grout mixture to blend with the finished surface?

(5) Is grout being applied so as to fill all pits, voids, and surface holes solidly?

(6) Is the excess grout being scraped off at the proper time with a trowel and is the flush surface then cleaned to remove any visible grout film?

(7) Is curing being planned so as not to allow grout to become dry during the setting period?

(8) Has any loose dry grout been left on the surface?

d. Rubbed Finish

(1) Check for exterior exposed-to-view areas requiring rubbed finish.

(2) Rubbed finish is performed after the surface has received a smooth finish. Rubbed finish is rubbed with Carborundum stones and water.

(3) Check to see that no mortar or grout is being used during rubbing, and that all grout which has worked loose during rubbing is removed.

(4) Check to see that the rubbing operation removes all form marks and similar blemishes.

e. Monolithic Finish

(1) The ordinary finish for floors and roof slabs is the monolithic finish.

(2) Make sure that all coarse aggregate has been forced away from the surface before screeding and straight-edging begins.

(3) The timeliness of the floating and of the troweling is important. Make sure the surface is floated as soon as it will bear the weight of a man without deep imprint, and that it is troweled as soon as the moisture which

was worked up from the floating operation has disappeared. Do not allow the addition of water or of dry cement.

(4) Check to see that the surface is steel-troweled to a smooth, even, impervious finish, free from trowel marks.

(5) Check the requirement for the number of steel-trowelings.

(6) Become familiar with the contractor's optional requirement to provide one-half inch topping; in case the contractor should desire to use this finish.

(7) Do not permit use of trowels cleaned in form oil, silicone, or similar bond-breaking materials unless such materials have been removed from trowel.

201-09. CURING, PROTECTION, AND FINISHING OF JOINTS

a. General

(1) Check the details of permissible methods and the number of days required for curing. Curing is the treatment given the concrete to insure that adequate moisture is available for hydration of the cement, with consequent gain in the strength of the concrete.

(2) Protection is the treatment given the concrete to insure that neither its appearance nor its strength is impaired by running water, premature or excessive loading, blows, freezing, excessive heat, excessive temperature differentials

within the concrete, etc.

b. Curing

(1) Is the approved curing medium being applied immediately after placing and/or finishing?

(2) Prevent use of membrane compound on concrete that is to receive paint, tile, roofing, hardner, etc.

(3) Where moist curing is being used, is it continuous--not intermittent?

(4) Are wood forms which are left in place kept wet for the duration of the curing period?

(5) When waterproof paper or other approved covering is used, are laps and edges sealed?

(6) Check the spray equipment when curing compound is used.

(7) Is the sprayed membrane:

(a) Free from punctures, abrasions, scratches or other discontinuities which will permit loss of moisture?

(b) Reapplied, if subjected to heavy rainfall within 3 hours after application, or when damaged by subsequent construction operations at any time during the curing period?

(c) Protected, to avoid damage from pedestrian and vehicular traffic or any other cause which would disrupt the continuity of the membrane?

(d) Do not allow surfaces to dry. If concrete is surface dry, require moistener with fine spray of water before spraying with membrane.

c. Finishing of Joints

(1) Observe joints for proper dimensions.

(2) Make sure that the joints are clean prior to sealing.

(3) Inspect the sealing of the joints. See that the joint sealer is placed flush with the surface and that all unsightly applications are corrected.

d. Protection

(1) Are precautions taken to protect surfaces from rain, snow or flowing water until they have set sufficiently to resist damage?

(2) Determine requirements governing the time to remove forms and supports, and obtain instructions from your supervisor as to special conditions which may govern, such as strength of control specimens, special approval for

earlier removal, or special requirements for deferring removal.

(3) Is adequate covering provided to protect concrete from damage by other construction activities? (Special attention must be given to corners, edges and projections which are not only especially susceptible to damage but are also most difficult to repair satisfactorily.)

(4) Is loading controlled so that new concrete is not stressed beyond its strength? Examples: Backfilling against new walls; storage of materials on new floors.

(5) Check for coverings and heating equipment in cold weather as necessary to maintain temperatures. Temporary combustible coverings, including tarps, must be secured clear of heating equipment. Use of low density fibre board, insulation with combustible covers, or vapor barriers must be prohibited. Heater fuel storage and arrangements for refueling should be carefully checked.

(6) Are thermometers installed to check the difference in temperature between surface and interior of concrete?

(7) Check the removal of protection. Do not permit concrete to be subjected to sudden extreme change in temperature. A 25 degree F. differential in temperature between the concrete and the surrounding air is considered as the maximum.

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